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January 1947

NAMES & NEWS

Dr. Manuel Antorveza Visits United States

Dr. Manuel Antorveza, Assistant Director, National Department of Agriculture, Bogotá, Colombia, came to the United States late in the summer to study wheat and potato research and production methods. Dr. Antorveza's trip was sponsored by the Colombian Government.

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Julius Matz Returns to Canal Zone Experiment Gardens

Julius Matz, of the USDA Bureau of Plant Industry, Soils, and Agricultural Engineering, who has been in the United States on leave of absence, recently returned to the Canal Zone Experiment Gardens, at Summit, where he is in charge of the Reference Collection of Sugarcane Varieties assembled at the Gardens by BPISAE. On his return trip Dr. Matz visited a number of sugar-production centers in Mexico and Central America, where he made a series of studies of sugar production including the spread of virus disease of sugarcane.

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Samuel C. Dews And Harmon R. Johnston Visit Canal Zone Experiments

Samuel C. Dews and *Harmon R. Johnston,* USDA Agricultural Research Administration, spent some time last fall in the Canal Zone examining the results of a series of standardized soil poison tests to determine the most effective chemicals for the protection of buildings from attack by termites. They also examined a number of trees into the sapstream of which chemicals had been injected to protect them from attack by termites. This work has been carried on by the Bureau of Plant Industry, Soils, and Agricultural Engineering and the Forest Service of the USDA. Data from these experiments will be of great value to civilian and military engineers in the construction of buildings and bridges in the American tropics.

Francisco Valdés Barry To Study For Year Here

Francisco Valdés Barry, Agricultural Experiment Station, Santiago de las Vegas, Cuba, has come to the United States for 1 year to study entomological identification, classification, and statistical methods. His trip is sponsored by the Cuban Government.

●

Enrique Serrano and Ismael Pereira Visit U. S.

Enrique Serrano, Society of National Agriculture, Santiago, Chile, and *Ismael Pereira,* Chilean Chamber of Deputies, spent 6 weeks in the United States last fall for the purpose of making special agricultural studies. The two Chileans were especially interested in rice, citrus fruit, wine, hybrid corn, olives, nonirrigated pastures, livestock, and agricultural machinery.

●

Carlos Galvão and Ruy Malta Study U. S. Agriculture

Carlos Galvão and *Ruy Malta,* of the *Instituto Agronômico do Norte,* Belém, Pará, Brazil, recently completed a 2-months stay in this country during which time they made a study of U. S. agriculture. Sr. Galvão made a study of beef and dairy cattle, hog breeding and feeding, dairy manufacturing, plant breeding, forage crops, sugarcane, corn, and cotton. Sr. Malta was particularly interested in studying Extension Service and Soil Conservation Service methods.

●

Latin American Engineers Come to U. S. For Training

Thirteen electrical engineers from nine Latin American republics came to the United States last fall for a year of training under the direction of the USDA Rural Electrification Administration. The group will receive instruction in the construction and operation of rural electric power systems. Following an intensive English language course in Washington, the Latin Americans will be trained both in REA headquarters and in the field, where they will be shown the REA-financed cooperative rural electric systems, facilities of the Tennessee Valley Authority, factories that produce electrical equipment, and various universities and research centers.

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Agriculture IN THE *Americas*

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Equatorial Currents—Asset to Middle American Agriculture

Among the various factors which influence the temperature and moisture conditions in Middle America, the warm equatorial ocean currents play an important part. This article brings to our attention the flows and destinations of these currents, with such physical data concerning them as are known.

by ATHERTON LEE

During the war many strategic materials were produced from the tropical agriculture of South and Central America. In the present postwar period some of these strategic crops, which are of a nature complementary to those produced in the United States, are continuing to receive considerable attention. Continued efforts for their production, it is felt, will contribute to improved economy and security in the Western Hemisphere. In this work the United Fruit Company is actively engaged, and the writer has been making an extended study of areas where climate is particularly suitable for their production.

Of these crops, a number are dependent upon fast growth for cheap production and superior quality, and fast growth, in turn, is dependent upon high temperatures and adequate moisture. Such, for example, are abacá, balsa, and possibly bamboo for wood pulp. Balsa, in particular, depends for its quality upon light weight and low density, which are chiefly results of fast growth. A warm climate and well-distributed rainfall are, therefore, necessary for its cultivation.

Until recently we believed that faster growth and cheaper costs would be obtained from growing these products in countries near the Equator, where temperatures were believed to be higher, rather than in Central America. The present study presents data showing that Middle America has assets of warm temperatures and adequate rainfall which make possible the growing of these strategic tropical crops, and that the warm equatorial ocean currents play a part in influencing the temperature and moisture of the area.

Equatorial Currents Warm the Caribbean

Most of us learned in our geography lessons about the Gulf Stream, which with its warm moisture-laden air raises the temperatures and contributes to the rainfall of the southeastern United States and of northwestern Europe. The Equatorial Currents, however, have not been so generally known and understood.

Two currents in the Atlantic Ocean, known as the North Equatorial and the South Equatorial, are of particular interest to the Caribbean area. The first of these, the North Equatorial, flows westward between latitudes of 5° and 20° North. On reaching the Windward Antilles it divides, part passing into the Carib-

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Mr. Lee is Director of the Department of New Crops of the United Fruit Company. The material contained in this article is the result of research carried on by that company to determine temperature and moisture factors in Middle America influencing the possibility of growing strategic crops in that area.

bean by the Santa Lucía Channel and part curving northward to become the Antilles Current, which drifts to the north of Puerto Rico, Hispaniola, and Cuba to join the Gulf Stream.

The South Equatorial Current of the Atlantic flows westward between the Equator and latitude 20° South. Thousands of measurements from ships' calculations indicate that part of this current flows northwestward along the South American coast to the Granada Channel, through which it passes to the Caribbean. From there it follows the contour of 1,000 fathoms to the coast of Yucatán, where it joins the North Equatorial, and the two currents flow "with great force and volume" through the Yucatán Channel into the Gulf of Mexico.

The velocities and temperatures of these currents have been charted with detail and accuracy by the Hydrographic Office of the U. S. Navy. They change somewhat with the seasons but generalizations may be drawn.

Velocity—A chart for May shows the velocity of the North Equatorial Current at latitude 10° N. off Cayenne, French Guiana, to be 10.6 nautical miles a day. A nautical mile is equal to 1.15 statute miles. Thus the water at that point is traveling at the rate of a little more than 12 miles a day. When it enters the Santa Lucía Channel, it is traveling about 25.5 statute miles a day. The Southern Equatorial Current passes through the Granada Channel at a rate of about 36.5 statute miles a day. When, after joining, the two currents pass through the 100-mile-wide Yucatán Channel, the velocity is increased to nearly 40 statute miles per day.

Bamboo depends upon high temperatures and adequate moisture for fast growth.

Temperature—The ocean surface-water temperatures by months have been recorded for the Northern Hemisphere. Off the east coast of Nicaragua, for instance, they average 79.1° F. as a low in February and 82.7° F. as a high in September. Off Puerto Barrios in Guatemala the waters have greater temperature ranges, with a low of 78.4° F. in February and a high of 83.4° F. in September.

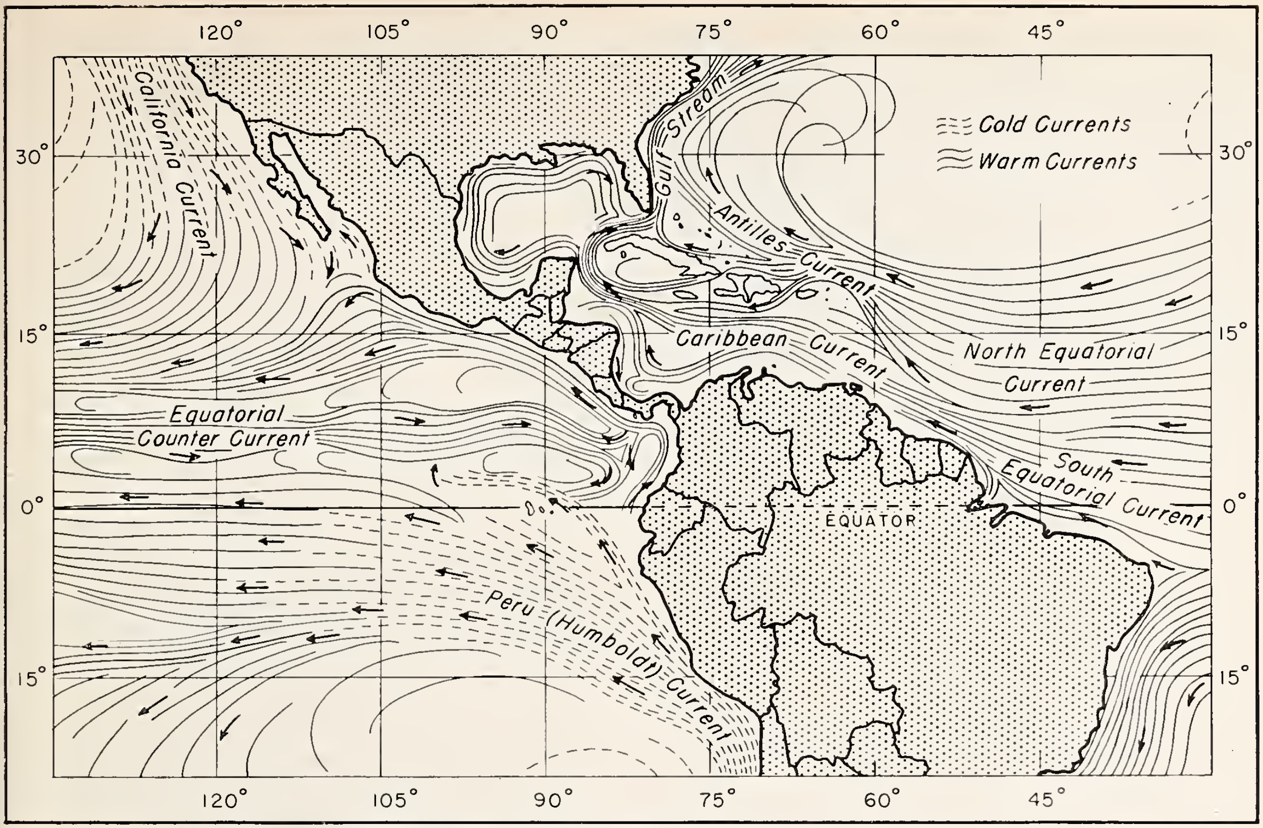
Records of water temperatures in the Atlantic Ocean in February, May, August, and November indicate that the highest ocean temperatures in the Atlantic are found in the Caribbean, with the exception of small areas off Brazil and the Guianas in November and February. The isotherms given in the World Atlas of Sea Surface Temperatures, from data compiled by the Scripps Institute of Oceanography at La Jolla, Calif., show temperatures of 80° F. in January as minima and 80° to 82.5° F. in August as maxima for waters off the Caribbean coast of Central America.

Volume—In the Atlantic the Equatorial Currents extend through 20° of latitude to the north and south of the Equator. The Antilles Current has been estimated to convey 40 cubic miles of water past Puerto Rico every hour. One must understand the tremendous volume of this warmed water which drifts along the Caribbean Coast of Middle America in order to appreciate its material effect on the temperatures and, consequently, on the agriculture of this region.

Humboldt Current Cools Western South America

In the Pacific the Humboldt Current is probably more widely known than the Equatorial Current. It flows north along the west coast of South America from the Sub-Antarctic. While the Equatorial Currents are warming the Caribbean coasts of Middle America, the Humboldt Current is cooling the western coast of South America.

This current, also known as the Peru Current, is a comparatively narrow belt of cold water, about 200 miles wide at 30° S. latitude and about 1,000 miles at 10° S. latitude. Its velocity off the coast of Chile is recorded as approximately 18 miles a day; off Peru,



Equatorial currents bring warmth and moisture to the shores of Middle America.

a little over 55 miles; off the Gulf of Guayaquil, Ecuador, nearly 28 miles.

Temperatures of surface water recorded off Point Santa Elena, which is the northern limit of the Gulf of Guayaquil, are several degrees higher than those off Cape Blanco, which is the southern limit of the Gulf. This would seem to indicate that the Humboldt Current turns westward off the Gulf of Guayaquil. Other evidence indicates that the northern boundary of this current fluctuates to some extent.

Possibly the high snow-capped mountains of Ecuador and Peru create cold air drifts which help to lower air temperatures on the narrow coastal plains of the Pacific coast of South America. Possibly heavy fogs may lessen the degree of radiation which the earth receives from the sun, known as insolation. In any case, the following records* from the files of the U. S. Weather Bureau bring out some interesting facts in regard to the climate of Central America. The mean annual air temperatures in Central America, extending from about 8° to 16° north of the Equator, recorded over periods varying from 3 to 23 years, are: Cristobal, Panama, 80° F.; Bluefields, Nicaragua, 79° F.; Trujillo, Honduras, 80.8° F.; Puerto Barrios, Guatemala, 81.2° F. The mean annual air temperatures recorded on the Pacific coast of South America in the section from the Equator south to about 18° S. latitude but cooled by the Humboldt Current are: Guayaquil, Ecuador, 78° F.; Piura, Peru, 76° F.; Chiclayo, Peru, 70° F.; Iquique, Peru, 64° F.; Arica, Chile, 64° F. These figures show that the Caribbean coast of Central America, which begins about 600 miles above the Equator and extends some 800 miles north, has actually slightly higher temperatures than the Pacific coast of South America beginning nearer the Equator and extending to about 18° South, which is washed by the Humboldt Current. On the other hand, mean annual temperatures on the east coast of South America, warmed by the Equatorial Currents, at or near the Equator range from 79° to 81° F.

Tabulated records of air temperatures over the sea at the Equator and successively at various latitudes north in the same range of longitude show that not until one reaches 20° N., which is well up into Mexico,

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*Furnished through the courtesy of Mrs. Blanche Hull, Meteorologist, U. S. Weather Bureau.

Experiments have shown that abacá fiber (manila hemp) can be grown successfully in the Western Hemisphere. Prior to the war practically all abacá came from the Philippines.

do mean monthly air temperatures over the sea fall as low as at the Equator off Ecuador.

Western Central America Has Ocean Currents Too

Central America's west coast surface waters have higher temperatures than one would expect in view of the cool California and Humboldt currents. Summarized records show mean monthly sea-surface water temperatures on the Pacific side to be 80° F. as minima in February and 82.5° as maxima in April and May.

This area is the meeting place of three great currents of the Pacific—the California, the Humboldt, and the Pacific Equatorial Counter Current. The position of the meeting of these currents fluctuates with the seasons. The California and Humboldt currents are cooling drying influences, but the Pacific Equatorial Counter Current is a warming influence.

Another factor to be considered is the insolation of the region. A publication by Merrill Bernard and associates brings out the fact that in the dry season, when the sky is clear, the receipt of solar energy is at a maximum. Thus the high degree of insolation associated with the cooling drying currents on the Pacific side modifies to some extent the sea and land temperatures, just as the warmer temperatures contributed by the Equatorial Currents on the Caribbean side may be modified by the lessened insolation due to more water vapor and cloudiness.

Equatorial Currents Favor Rainfall

The Equatorial Currents, consisting of waters at higher temperatures, give off more water vapor and the air above them contains, therefore, more water vapor than the air above colder waters. This air, drifting over the land areas of Central America, is more unstable and water may be more easily precipitated from it by the elevations of mountains, cold fronts, or convection, than from the air over the cool Humboldt Current. The average precipitation of rainfall recorded, in inches, for Puerto Barrios, Trujillo, Bluefields, and Cristobal are 124.8, 92.5, 155.3, and 125.6 respectively, as against practically none in Arica, Chile, and Iquique, Peru.

Advantage to Middle America From Equatorial Currents

Instead of serious climatological disadvantages as compared to the rest of the Hemisphere for the production of such crops as abacá, balsa, and bamboo, Middle America, including Central America and the Antilles, has decided advantages resulting from the influence of the Equatorial Currents which flow through the Caribbean Sea and on to form the Gulf Stream.

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Poultry Conditions In Latin American Countries

by MORLEY A. JULL

The production of eggs and of chicken meat is a widespread enterprise in most Central and South American countries. In some, the poultry industry is more advanced than in others, but in practically all countries the quality of breeding stock, efficiency of egg and meat production, and marketing methods might be improved.

Practically all South and Central American countries would benefit from a better balanced agriculture, with more emphasis on the dairy and poultry industries. The poultry industry has an advantage over other livestock industries in providing the flock owner with regular income throughout the year. The income from the flock will go a long way toward buying groceries, school books and clothes for the children, and many other necessities of life.

Poultry Industry in Argentina

In Argentina the poultry industry is important. During recent years there has been a steady increase in production, home consumption, and export. The Provinces of Buenos Aires, Santa Fe, Córdoba, and Entre Ríos have three-fourths of the total population of about 50 million birds. Value of the commercial production of eggs and poultry amounts to about 180 million pesos annually, about $54,000,000 in U. S. money. In 1944 the value of egg exports amounted to 28,575,561 pesos, divided between 9,477,000 kilograms of shell eggs and 3,795,395 kilograms of dried eggs. The processing of dried eggs has increased in importance every year for several years. In 1944 the value of frozen poultry exports amounted to 10,340,000 pesos, accounted for by 5,588,116 kilograms.

The Department of Agriculture of the Federal Government is carrying on a progressive educational and research program in behalf of farmers and commercial poultry producers. Portable exhibits of improved poultry practices are staged at public meetings. Egg-laying contests are held for the purpose of encouraging the adoption of better poultry-breeding methods. Research work on various projects is carried on at regional poultry experiment stations.

Brazilian Poultry Industry

During the past 4 or 5 years considerable impetus has been given to the improvement of poultry conditions in Brazil. The southern State of São Paulo has the largest poultry population, numbering some 11 million head. Here about 10 percent of the eggs are produced on commercial farms, where approximately 80 percent of the flocks are White Leghorns, 18 percent are Rhode Island Reds, and the other 2 percent represent different breeds. There are a few commercial hatcheries and one egg-drying plant.

In the northern section of Brazil poultry projects have been developed in Baía, Ceará, Pará, Piauí, Sergipe, Alagoas, Paraíba, Amazonas, Maranhão, Pernambuco, and Rio Grande do Norte. The Brazilian Ministry of Agriculture established a poultry training school at Rio de Janeiro to train students in

A number of Brazilian experiment stations, as well as the Min istry of Agriculture, are encouraging the raising of turkeys in that country. This is part of a turkey flock at the Paraíba State Experiment Station.

New Hampshire chicks at the Animal Production Section of the Pernambuco State Department of Agriculture, Recife, Brazil. These chicks were hatched from eggs shipped by airplane from the University of Maryland.

poultry-husbandry practices. With headquarters at Recife, the Ministry of Agriculture developed some 36 specific poultry projects to give instruction in housing, feeding, brooding, and candling and grading of eggs. Many hatching eggs have been imported by airplane from the United States to provide foundation stock to improve laying ability.

A National Poultry Farm has been established by the Ministry of Agriculture at *Kilometer 47,* out of Rio de Janeiro, where the National Agricultural School is located.* Here research in breeding, feeding, disease control, and preserving quality in eggs and poultry meat will do much to stabilize conditions in the poultry industry, develop a more efficient husbandry, and increase the consumption of poultry products.

Mexico Has Many Farm Flocks

The Mexican poultry industry is largely a farm industry, over 90 percent of the poultry of the country being located on general farms. According to the latest census estimates, there are approximately 35,275,000 chickens and 1,845,000 turkeys in the country. In Mexico nearly as much chicken is consumed per capita as either beef or pork, as chicken meat is an important ingredient of many of the country's dishes. Turkey meat is used principally in the preparation of a national holiday dish, turkey with mole, mole being a sauce prepared from 15 or more herbs and spices.

White Leghorn, Plymouth Rock, and Rhode Island Red are the most popular breeds. About 5 percent of the total egg production is on commercial farms, located near large cities. The largest commercial poultry farm is in the northern part of the State of Baja California and has about 25,000 layers. Egg prices have doubled within the past 2 or 3 years. Considerable quantities of eggs and numbers of chicks are imported annually from the United States.

Chile Stresses Poultry Plants

The laying-flock population of Chile is about 3,500,000, of which some 700,000 are kept on commercial poultry plants. White Leghorn, Rhode Island Red, and Catalonian de Prat are the most popular breeds. Annual egg production amounts to about 227,000,000; average per capita consumption is about 62 eggs. Duck raising is carried on to some extent, many of the eggs produced being used for making soup paste and noodles. A few turkeys are raised, mostly on farms. Artificial incubation of chicken eggs is carried on to a considerable extent, one of the largest hatchery establishments belonging to the Association of Poultry Raisers, with a total capacity of 200,000 eggs. The Federal Department of Agriculture conducts poultry schools throughout the country in order to advise farmers on up-to-date methods of production.

In Peru and Other Countries

In Peru, the Livestock Division of the Ministry of Agriculture has recently conducted a census of the livestock industries, from which it has been determined that there are approximately 5,000,000 laying hens in the country, of which 1,000,000 are purebred. As many as 500 hens on a farm is a rarity. White Leghorns and Rhode Island Reds predominate. Annual egg production amounts to about 350,000,000, of which about 30 percent is produced on commercial plants. The cost of feed is relatively high, but prices received for eggs and chickens are good.

The Peruvian Poultry Association cooperates with the Federal Government in carrying on educational work to improve conditions in the industry. The Government conducts an Experimental Farm at La Molina, near Lima, where poultry experiments are carried on and breeding stock of good quality is supplied to breeders and commercial poultry raisers. Poultry farms have also been established in different

Dr. Jull was in charge of poultry research work for the Animal Husbandry Division of the U. S. Department of Agriculture from 1923 to 1936. Since then he has been Head of the Department of Poultry, University of Maryland.

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*See "Kilometer 47," by Guy C. Bush, in the December 1944 issue of *Agriculture in the Americas.*

zones of the country, especially in the Sierra, for the purpose of training instructors and improving the breeding quality of laying stock. Incubators and high-quality hatching eggs and chicks have been imported in considerable numbers from the United States.

With the exception of Cuba, the poultry industry in other South and Central American countries has not attained the importance it deserves. This is due partly to the lack of adequate supplies of feed and partly to limited marketing facilities. In Cuba the poultry industry has long been important, with considerable attention to commercial egg and broiler production.

In Colombia the poultry industry is relatively undeveloped, especially from a commercial standpoint. At the same time, the seasonal price of eggs in Colombia has compared favorably with that in the United States.

In Paraguay, Uruguay, and Venezuela the poultry industry is largely a farm enterprise, although only a few chickens are kept on each farm.

In the Dominican Republic, leading breeds kept are White Leghorn, New Hampshire, and Black Minorca. The Poultry Division of the Government distributes breeding stock to farmers to serve as foundation stock. In Costa Rica, White Leghorns and New Hampshires are popular with farm-poultry raisers, production on a commercial basis being almost unknown.

Sound Breeding Program

The primary objective of every market egg producer should be to produce the maximum number of superior-quality eggs on the fewest possible pounds of feed per dozen eggs laid. Most flocks of laying hens use too many pounds of feed. One of the outstanding needs of the industry is a marked improvement in the quality of laying flocks, which would lead to more efficient utilization of feed in the production of eggs. This is an important matter for every flock owner, because the cost of feed represents about one-half of the total cost of producing eggs.

Suppose a 5-pound 100-egg bird consumes about 80 pounds of feed during the laying year, whereas a 5-pound 200-egg bird consumes about 94 pounds. The 100-egg bird consumes over 9½ pounds of feed per dozen eggs produced; the 200-egg bird, about 5½.

The kind of diets fed to the laying stock and the methods of management affect the number of eggs laid. Yet, the egg production of two strains of the same variety may be quite different, even when the two strains are fed the same diet and are kept under identical conditions. The difference is due to breeding. Neither the best kind of diet nor the most careful management will enable pullets to lay well if they are not bred for high egg production.

In order to lay well, pullets should possess four outstanding characteristics: (1) Early sexual maturity. White Leghorns should commence to lay at about 150 days of age and the general-purpose varieties at about 170 days of age. (2) Pullets of all varieties should lay at an average rate of about 50 percent production, or about 15 eggs a month, or better, on the average. (3) There should be little or no broodiness. White Leghorns usually do not exhibit much broodiness, but general-purpose varieties must be bred for nonbroodiness or there will be numerous interruptions in laying. (4) Pullets of all varieties should continue to lay for a period of approximately 10 months from the time they start to lay.

The ability to lay well is inherited, and, except for a minor detail, a pullet inherits laying ability equally from her sire and dam. More profitable laying flocks for farmers and commercial poultrymen can be developed only through a sound breeding program.

The pedigree breeder has a big advantage over flock owners who do not trap-nest their layers, because he can select future breeding stock on a family basis. Families of full sisters that commence to lay relatively early, lay at a good rate, are relatively free of broodiness, and are persistent producers make far better breeders to develop high-laying strains than families of full sisters that are poor or mediocre in these four traits. Each trait is inherited and can best be developed by progeny testing, that is, selecting breeding stock on the basis of the performance of a family.

Incubator in operation at La Molina Experiment Station, near Lima, Peru.

Venezuela's new *Instituto* is located on the 6,000-acre Hacienda El Limón, near Maracay, at the base of the coastal range of mountains. The magnificent trees and other natural attractions have been retained.

Venezuela's New Instituto Nacional de Agricultura

In the coastal range of mountains paralleling the Caribbean Sea, 300 feet above beautiful Lake Valencia, Venezuela is building its fine new National Institute of Agriculture. This marks a milestone in the development of agricultural research in Venezuela.

by J. H. KEMPTON

Venezuela has taken an important stride forward in the advancement of its agriculture by the establishment of a new Agricultural Institute and Experiment Station for research and teaching at Hacienda El Limón, near Maracay. On this property, consisting of 6,000 acres, located in the coast range of mountains 300 feet above Lake Valencia, already some 20 buildings have been erected, covering slightly more than 510,000 square feet in area. By the middle of 1947 the work of the *Instituto Nacional de Agricultura* should be in full swing.

To all but Venezuelans themselves, Venezuela is today synonymous with petroleum. Yet, although a million barrels of this liquid wealth leave daily for world markets, agriculture is by far the most important activity and the means of livelihood for about two-thirds of the people.

Before the exploitation of petroleum, which is a relatively new comer to the economy, Venezuela's foreign trade was supported almost wholly on coffee and cacao. These crops, consumed largely outside the country, depended more for their success upon prices in foreign markets than upon production efficiency at home. For years both crops were highly profitable and provided the economic foundation for the landed aristocracy.

During this period, which lasted well into the petroleum era and was definitely upset only by the devaluation of the pound and dollar, little attention was given the staple farm crops. Coffee and cacao were produced principally by large landowners who were not particularly interested in encouraging State experimentation. So long as these crops were profitable they did not stimulate even private experimentation, and, when the profit margin vanished, it was too late.

Food Problem Created First Agricultural College

During the 27 years of the Gómez regime, which covered the period of petroleum development and saw the world slip off the gold standard, urban expansion began in Venezuela. Caracas, which today has about 400,000 inhabitants, had but 70,000 at the turn of the century, and other urban centers have expanded at equal speed. Vast land holdings of what had been fertile haciendas were accumulated and converted into cattle ranches. Almost unnoticed, a problem of furnishing food for the increasing numbers of people who were leaving the land was created.

Among numerous long-delayed reforms undertaken after 1935 was the creation of a Ministry of Agriculture, formed from a section of the Ministry of Public Health. This new Ministry, understandably lacking in personnel trained in agriculture, established in 1937 an agricultural college and experiment station on a small hacienda at El Valle on the outskirts of Caracas. This institution, known as *Instituto Experimental de Agricultura y Zootecnia,* was the beginning of organized agricultural research in Venezuela.

Decades will be required to bridge the chasm between the old Colonial agriculture and modern practices. The populace has been impatient, naturally, to make up for lost time, an impatience fostered by the necessity to meet the food demands of the ever-increasing group which has moved off the land. There has been little public understanding and appreciation of the problems which must be solved before the agriculture known in the agriculturally progressive countries can be modified and adapted for Venezuela.

The institution at El Valle, however, made progress, and by 1942 it had not only proved its worth but had also outgrown its facilities. The college had trained a nucleus of young men who were ready and anxious to put their new learning to public use.

The New Instituto Nacional de Agricultura

Having this group of trained men, the Government decided to move its agricultural institution to a larger area in an agricultural region. After careful consideration, the 6,000-acre property of El Limón, near Maracay, in the State of Aragua, was selected. It lies at the inside base of the coast range of mountains 1,500 feet above sea level and can be expanded down to Lake Valencia, 300 feet below, or over the mountains to the sea.

The mountain range itself is a National Park and the seat of Dr. William Beebe's tropical laboratory at Rancho Grande. On the sea side of the range north of El Limón, about 30 minutes by concrete highway, is the chief cacao experimental station of the Ministry of Agriculture. This will become an active part of the new station. The large tropical forest of this National Park is expected to provide a first-class laboratory for the School of Forestry, and the deforested foothills should make an excellent training ground for the young men on whose shoulders will fall the task of restoring much of the burned-over mountain lands.

In the nearby City of Maracay is located the newly completed and highly regarded Division of Malariología of the Ministry of Public Health, with its modern laboratories and biological staff. Here, too, will be centered the malaria research for Northern South America of the Rockefeller Foundation.

In setting up the *Instituto Nacional de Agricultura* the Venezuelan Government appropriated $3,000,000 for structures, roads, stream relocation, and general development. In order to arrange the buildings in harmonious design, one stream had to be relocated and the grade of the existing concrete highway elevated. New connecting avenues were provided, giving ready access to the Institute from three directions.

The property has been surveyed and topographically mapped in detail. The department of soils of the agricultural college and experiment station made a detailed soil survey, and Dr. Mortimer Lewis of the U. S. Reclamation Service, on contract to the Ministry of Public Works, made a careful study of irrigation, drainage, and water supply. Several streams traverse the hacienda, but during the dry season supplementary water will be needed to augment stream flow for irrigation. Because of the geological formation a storage dam was deemed too costly. As an ample supply of ground water is available, the decision was made

Experimental blocks of checkrowed corn, Agricultural Experimental Station, *Instituto Nacional de Agricultura.*

to obtain the supplementary irrigation water from drilled wells. Electricity for pumping is provided by the hydroelectric plant which supplies current for Maracay. Plans for laboratory and domestic water supply are being made by Dr. George C. Bunker, of the Ministry of Public Works, who is the Government's adviser on the domestic water supplies of the country.

The design and construction of the laboratories, residences, classrooms, dormitories, stadium, library, auditorium, and the numerous other buildings and structures that make up the physical plant of an institution of this sort were entrusted to the Ministry of Public Works. Each professional leader sketched the requirements for the housing of his project, and, after many time-consuming conferences, these were fitted into an harmonious building plan by the architect, Louis Malaussena, and Dr. Walter Cadmus, of the USDA, without sacrificing technical needs. The buildings are arranged not only in harmony with each other but also in such a manner as to leave most of the fine large trees, which means that the Institute will have a pleasing aspect from the beginning.

At this date twenty buildings are either completed or are nearing completion: Soils, Entomology and Phytopathology, Agronomy and Agricultural Engineering, Seed Storage, Chemistry, Genetics, Faculty of Agronomy, Central Administration Agriculture, Zootécnica, Veterinary Surgery, Veterinary Laboratories, Central Administration Veterinary, Veterinary Medical-Dental School, Veterinary Infectious Diseases, Veterinary Organic Diseases, Veterinary Pharmacy, Animal Breeding, Dormitory, General Administration, and Shops and Warehouse.

The present program calls for a lecture hall for students, an auditorium, library, casino, cattle barns, and tick baths. It provides for some 60 residences for the staff, with provisions to increase this number to 100 in the future. Each of these houses will have grounds of 1 acre and face a center park avenue. Also to be constructed is an apartment house for use by visiting professional men. These facilities are expected to enable professors of foreign universities who have something to contribute to Venezuelan agriculture to spend at least part of their sabbatical leave at the *Instituto Nacional de Agricultura.* By this means the staff and students will have the advantage of wide contacts and will be kept intimately informed of progress elsewhere.

In addition, several more buildings are projected, but the plans for them have not been settled. Among these are buildings for botany, including the National Herbarium, for forage crops, horticulture, and several for the Veterinary College.

As there is plenty of land and no heating problem, the buildings are limited to one floor. The construction of all buildings is concrete frame, with brick fill, and the walls are to be plastered outside and in. Roofs are flat cement slab, and the floors are tile. Brick kilns

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The author is Agricultural Attaché at the American Embassy, Caracas, Venezuela.

have been set up on the property and are turning out the thousands of brick needed.

Some of the laboratories were expected to be functioning for the past crop season, particularly genetics, entomology, phytopathology, agronomy and agricultural engineering, but shipping delays on metal fittings from the United States interfered with finishing walls and floors. In the meantime, field work is progressing in the sections of agronomy, soils, and genetics. The first season about 100 acres were under cultivation in tests of check rowing and machine harvesting corn, fertilizer experiments with cotton, and the machine handling of grain sorghum, and this past season an additional 200 acres were in cultivated crops. These are being used chiefly for agronomic experiments on costs of production studies and cultural problems.

Until some laboratories are completed, the main genetic work of the Institute will continue on a nearby hacienda, which has been used for this purpose for the past 3 years. Hacienda Gonzalito has laboratories, electric seed dryer, ample storage capacity for pure seed of corn, sesame, cotton, and rice, with fumigation chamber and two large cold-storage units. It has available some 400 acres, partly serviced with pumped irrigation water. When the *Instituto Nacional* at El Limón is completed, this present genetics station will be used for the multiplication of pure seed.

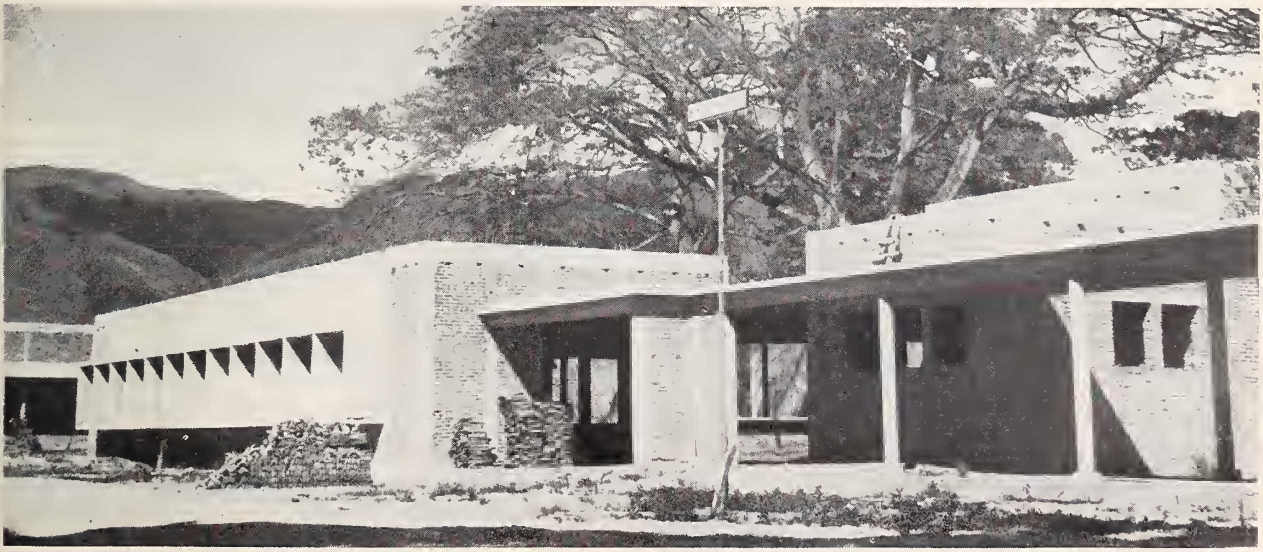
Research and Management

Agricultural research in Venezuela is not limited, of course, to the central experiment station; there are many substations where work of local import is conducted. It is expected, however, that the El Limón situation, with its various altitudinal climates, will become the center of most of the basic investigations.

The present Government is well aware that buildings do not make an agricultural institution, though they do help mightily in facilitating investigations. It has every intention of providing an adequate staff even though in these beginning years much of the staff must be recruited outside the country.

In order to establish the *Instituto* on a logical plan, the *Junta Revolucionaria de Gobierno* appointed by decree a technical council, which has full responsibility for planning the work and scope of the Institute. President of the council is Dr. Ramón Pinto Salvatierra, formerly head of the Agricultural College and Experiment Station at El Valle and now the chief administrative officer of the Ministry of Agriculture. The other members are *Ingenieros Agrónomos* Carlos Rojas Gómez, Mauricio Báez, Ricardo Jahn, Fernando Polanco, and Eduardo Mondolfi; *Médicos Veterinarios* Claudio Muskus, William Larralde, Paulo Llamozas González; Drs. Derald G. Langham, Louis María de Elizalde, Charles Ballou; and advisers J. H. Kempton, Mortimer Lewis, and Arturo Burkart. This council meets weekly, or more often if necessary, and functions by means of subcommittees assigned various fields of operation.

By the time the buildings are occupied, the orientation and organization of the *Instituto* will have been accomplished. There will, of course, be many problems, the solution of which will depend upon the success in finding the proper investigators, but the existence of adequate facilities will be an important inducement in securing the most efficient personnel.



Part of the Genetics group. As there is plenty of land and no heating problem, the buildings are limited to one story.

Market Day in Vacas

by **OLEN LEONARD**

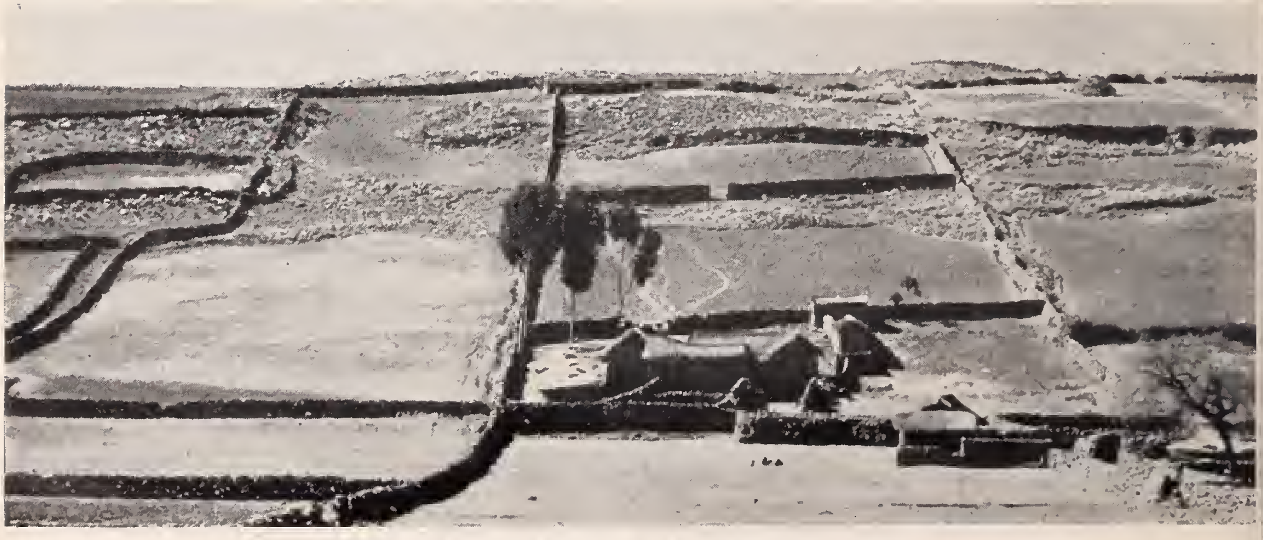
Bolivia has been called a land of contrasts. Geographers have divided Bolivia into three widely variant regions: The high Andean Plateau, the intermediate valleys, and the tropical lowlands. Actually there is a fourth, the *cabeceras de valle,* long deeply cut valleys in which small rivers flow down the eastern side of the Cordillera to the Amazon Basin. In these diminutive and generally extremely isolated valleys live tribes or groups of people who seldom see outside the walls of the valleys.

Habits, customs, and traditions of a people persist longest in isolated areas. This thesis is clearly supported in the *cabeceras de valle* of Bolivia, where customs and types of dress thought to have gone with the Inca Civilization still persist. A mountain spur or ridge in this region may separate peoples of widely different cultures.

Vacas is one of Bolivia's *cabeceras de valle.* Age of the settlement is not known, but local residents claim that it dates back well into the period of the Incas, a claim attested by well-worn cobblestone streets and unusually thick walls. It lies at about 12,500 feet elevation among a group of fresh-water lakes. A series of high valleys surround the town of the same name, through which will run the Cochabamba-Santa Cruz Highway now under construction by the Bolivian Development Corporation.

Vacas is high, cold, and relatively windy. Such unfavorable climatic factors obviously limit agricultural possibilities. Potatoes are the principal crop grown, but patches of horsebeans, wheat, and oka are common. Small herds of cattle and larger ones of sheep are owned by practically all families. They provide the small amount of meat eaten by the people and such cash as is needed from time to time to buy those products that must come in from the outside world. Much of the land is owned by people who live outside the valleys and is rented to those who till it. Many families, however, own their homesites and small patches of land devoted to barn and garden. When the family owns no land, it usually builds a house on the land of the proprietor. The ownership of such houses is divided between the families and the proprietors, floors and windows belonging to the families and walls and roofs to the proprietors.

The market area of Vacas is the plaza or village square, around which the people spread their wares at an early hour. Products are brought in from far and near, and from daybreak until midmorning on Sunday, the market day, one can hear the lusty shouts of "Bur-r-r-r-ro," "Bur-r-r-r-ro," as the people push their heavily laden little donkeys in from the countryside. Upon reaching the market place, products,



Houses, fields, and pastures of a typical Bolivian farm.

Waiting for a customer at the market place.

mostly food, are spread on *mantas* or blankets. The vendor, usually the homemaker of the family, squats on her many heavy woolen skirts beside them, and the day's trading has begun. There are potatoes from Vacas, fruit, vegetables, and *chicha* from the distant valleys, and medicinal herbs and roots from the high Sierra. Drab, heavy colors of clothing characteristic of the Sierra mingle in sharp contrast to the more gay and bright colors which set apart folks from the valleys.

Families living at shorter distances from the market depend more heavily upon human than animal backs for transportation. As a rule families carry their own products, but they may hire professional carriers for the purpose. One does not often hire donkeys here for transportation; they are too expensive. One marvels at the strength and endurance of the so-called weaker sex in this division of labor, as they trudge along the dusty roads carrying not only their share of the market produce but likely a child and a whorl and spinnel as well. With this equipment they will spin yarn in the market while waiting for customers. No carts or wagons are used in transportation, not even by those who bring relatively large quantities of goods along traversable roads and over considerable distances.

The value of goods, animals, or a day's work in Vacas is not measured in terms of money but in a given quantity of potatoes, the predominant crop of the region. Potatoes are traded for local products and also for sugar, fruit, condiments, and clothing brought into the area by merchants from the valley towns. Such trading is not in terms of pounds of potatoes but in stacks or mounds—so large a mound for a pair of shoes, another-size mound for a hat. Few, if any, of these potatoes are for sale. Neither of the interested parties would likely know the value of the potatoes in terms of the local currency. Even should they know, it would not be of value since chances for profit are greater in exchange.

Factors far greater than economic enter into an exchange of goods in the Vacas market. It is not enough for a trader to know the value of goods. He must know how to best his opponents in an exchange of verbiage frequently derogatory to both the person and his product. Traders have their followers, and the size of the audience is a fair gage of the esteem in which the trader is held by the villagers.

The market in Vacas has become highly institutionalized. It is a place where the people for miles around go each week to exchange their products, meet friends and relatives, listen to the local musicians, and perhaps forget their arduous and monotonous weekly existence in tall glasses of *chicha,* the popular fermented corn drink produced in quantities in the nearby valleys.

One would probably be correct in saying that the market is the hub around which the entire pattern of life in the valleys is woven. No resident, unless ill or otherwise incapacitated, would likely feel that he could remain away from the Sunday market without loss of status. Women as well as men feel this social pressure to attend the market, although admittedly the women have an added responsibility, that of seeing that the day's earnings go for things needed by the family rather than into the *chicha* vendor's purse. This by no means rules out a rather generous expenditure for *chicha,* which may be taken either to celebrate a good day's gain or to salve any hurt occasioned by losses.

Most of the farm products are moved to market on the backs of burros.

Dr. Olen Leonard is Acting Head of the Extension Training Division, USDA Office of Foreign Agricultural Relations. His article is based upon material gathered during a recent trip to Bolivia.

ALONG THE *Agricultural Front*

▲ Canada Seeks Brazilian Markets

Canada is showing interest in the development of Brazilian markets for seed potatoes. Canada produces about 6,000,000 bushels of seed potatoes in an average year, two-thirds of which are usually available for export. Largest purchasers at present are the United States, Argentina, Uruguay, South Africa, and Cuba.

Formerly Europe supplied more than four-fifths of Brazilian seed-potato requirements, but because of economic disruptions caused by war Europe will find it difficult to hold this proportion of the market. Prewar Canadian attempts to obtain a share of the Brazilian market were unsuccessful, owing to restrictive import regulations, which were relaxed by Brazil only partially in 1938. Test shipments of seed potatoes from Canada to Brazil were made last winter in an attempt to clear the way for more extensive imports in the winter of 1946.

A Brazilian market for Canadian apples also seems possible. Growers have been advised, however, that they must pack their fruit in boxes rather than in barrels in order to take advantage of the market.

▲ Nicaraguan Company Launches Flour Project

A new company, the Compañía Harinera de Nicaragua, was organized last June for the purpose of increasing production of flour in Nicaragua.

The company owns a flour mill at Jinotega, the only known flour mill in the country. The present machinery is old-type and can produce only about 150,000 pounds of flour a month, but new equipment and added capital are being sought to increase the capacity.

Investigation is also under way to determine the best type of seed and modern methods of cultivation of wheat. At present Nicaragua is reported to produce about 8,000 bushels of wheat annually on about 2,000 acres. With improved methods of cultivation on the land said to be available for growing wheat, Nicaraguans hope that enough wheat will be raised to furnish the flour needed for the Republic.

▲ Bamboo Aids Control of Soil Erosion in Puerto Rico

Among the many uses of bamboo, one of the most important is proving in Puerto Rico to be its usefulness in controlling soil erosion. One reason for this is that bamboo plants put out a mat of roots so closely woven that they hold soil under heavy washing conditions. Studies show that 83 percent of *Bambusa tulda* roots are present in the upper foot of soil, which is the area where roots serve best in controlling soil erosion.

A second characteristic which aids in holding the soil, especially on hillsides too steep for cultivated crops, is the accumulating of a 2- to 4-inch mulch of bamboo leaves beneath some species of bamboo, particularly *Bambusa longispiculata*. This both conserves moisture and helps to prevent soil erosion. In addition, bamboo foliage is very thick, thus arresting beating rains, and its habit of producing new culms from underground rhizomes allows harvesting of the culms for industrial purposes without disturbing the soil.

Bambusa vulgaris Schrad. is used widely in preventing landslides both above and below hillside roads, to maintain fills and steep road embankments, and to prevent the washing away of river banks during flood periods. Sometimes a revetment of bamboo culms is constructed, with clumps of bamboo growing behind it for further reinforcement.

▲ Cuba Plans To Improve Agriculture

The Cuban Government has announced plans to improve and bring about better balance in its agricultural economy. It has initiated an agricultural improvement program calling for expenditure of about $3,000,000 for the purchase and distribution of seed, for subsidies to farmers, purchase of additional farm machinery to be operated by the Government, purchase of breeding stock and livestock-improvement centers, construction of refrigerated warehouses for beef and fish, and for aid to fishermen.

Plans for the improvement program take into consideration the fact that farmers in Cuba, occupied largely with sugar production, have not fully utilized available land and facilities to raise much-needed food crops for domestic consumption. It is estimated that only about one-half of Cuba's tillable land is actually under cultivation.

▲ Brazilian Manioc Products in Demand

Shortages of industrial and edible starches have stimulated United States demand for importation of Brazilian flour, meal, and alcohol made from manioc, a tropical American root crop commonly known as cassava in this country and certain other parts of the world. Procurement of manioc flour and meal from Brazil by importers in the United States and Canada has reached the highest level since the war. At the same time, Brazilians are using much manioc flour, mixing it with wheat flour to take care of extremely limited supplies of the latter.

RIVERS OF NICARAGUA

by RUTH PARKER SCHOTTROFF

Nicaragua is bordered on the east by the Caribbean Sea and on the west by the Pacific Ocean. Low finger-like ranges of mountains with a few high peaks extend down from Honduras across west-central Nicaragua to within 50 miles of the Caribbean in the southeastern part. They divide the country into two general areas—three-fourths in the eastern area and one-fourth in the Pacific, where 75 percent of the population is concentrated.

In these highlands the principal rivers have their origin and flow eastward to the Caribbean. The east coast, about 300 miles long, is low and swampy, with numerous lagoons and estuaries. Temperatures here seldom rise above 90° or fall below 65° F. Average annual rainfall varies from 90 to 200 inches, though San Juan del Norte has around 300 inches. Bluefields and Puerto Cabezas, two of the principal harbors, can accommodate ocean-going vessels having a draft of less than 14 feet. San Juan del Norte is another important harbor.

The rivers in this eastern area, coming down from the highlands, flow through an almost uninhabited wilderness of timbered plains and rolling hills so rugged that the upper portions of the streams are full of rapids. Before reaching the coast they have become good-sized rivers, but navigation is mostly limited to light-draft boats because of shifting sandbars.

Río Escondido, formed by the junction of Río Mico and Río Siquia, is navigable to river boats and small ocean-going vessels for about 70 miles from its mouth, to El Recreo, where the Nicaraguan-United States Cooperative Agricultural Experiment Station has been established.

Barges are used on Río Prinzapolca for hauling freight and supplies to gold-mining areas in the highlands and for transporting pine timber down river to be exported.

Other rivers on the Caribbean side are the Wawa and Huesco, in what used to be a great banana country before the plantations were abandoned. Río Coco, or Wanks, is of historical interest. Christopher Columbus was the first white man to land at its mouth, when seeking shelter from a storm on his fourth voyage, in 1502, and he named the cape Cabo Gracias a Dios—Thanks be to God.

On the west coast of Nicaragua a range of volcanic mountains extends within 10 or 20 miles of the Pacific, with only short nonnavigable streams flowing into the ocean. The coast line is high, and the water close to the shore is deep. There are two harbors—Corinto, well protected and capable of accommodating ocean-going vessels at its wharf, and San Juan del Sur, which is small but deep and safe. In this western section average annual rainfall varies from 45 to 80 inches.

Between the Pacific Coast Range and the Central Highlands lies a depressed plain which contains two fresh-water lakes. Lake Managua is 40 miles long, 10 to 16 miles wide, and 127 feet above sea level. Lake Nicaragua, largest lake between the Great Lakes of North America and Lake Titicaca in South America, is 100 miles long, 45 wide, and 106 feet above sea level. Río Tipitapa joins these two lakes, and their outlet is Río San Juan, which runs along the border of Nicaragua and Costa Rica and empties into the Caribbean Sea. This has long been considered a possible route for a canal connecting the Pacific and Atlantic Oceans, requiring a 17-mile cut between Lake Nicaragua and the Pacific.

Nicaragua contains a vast area of forests. Estimates indicate that 80 percent of the land is in forest, 1 percent in cropland, and the remainder in abandoned banana land, grassland, and swamps. On the Pacific slopes the forests are mainly deciduous; on the Caribbean side practically all the trees are broad-leaved hardwood. Pines predominate in the north-central highlands and are found on the east coast, although not in a continuous stand.

Mahogany has always been the most valuable timber in Nicaragua. The trees now being cut come mainly from around the headwaters of the Escondido, Prinzapolca, Grande, and their tributaries. The logs are chained into rafts and floated down the rivers to ports for export. Bluefields, near the mouth of the Escondido, has always been the leading port for shipment of timber.

Castilla rubber trees are found throughout the country, but they are most abundant in the thinly populated rain forest of the eastern part. Although not the plantation type, they were tapped during the emergency war period.

Balsa is prevalent throughout the country and has been exported from the west coast for many years. Although more abundant on the east coast, often found on abandoned banana plantations, balsa trees have been cut only recently in the east for commercial purposes. Sizable stands of balsa are found along the Coco, Wawa, Prinzapolca, Grande, and San Juan Rivers and around the southern end of Lake Nicaragua.

Rosewoods, dyewoods, cedar, and lignumvitae also are abundant.

The estimated area of land under cultivation during 1943 was slightly over 378,000 acres, but the potential area of land cultivatable for agricultural purposes, including livestock, might be as much as 10,000,000 acres, should the requirements of the population warrant it. The settled parts of Nicaragua have always been predominantly agricultural, with the raising of crops and livestock the main occupation.

Corn and beans are the principal crops from the standpoint of volume, and they are grown wherever there is any population. In 1943 about 110,000 acres were in corn, 90,000 in beans. Largest acreages

(Continued on back cover)

Reading about the AMERICAS

Emulsion Technology, a symposium. 360 pp., tables. Chemical Publishing Co., Inc., Brooklyn, N. Y., 1946. This is a second enlarged edition. The theory and application of emulsions are discussed, with a new comprehensive list of emulsifying agents, and data on methods of formulation of many practical commercial emulsions in the fields of drugs, cosmetics, beverages, foods, polishes, waxes, coatings, and paints. Of special interest to agriculturists are the chapters on rubber latex and on emulsions used in agricultural spraying and in the wool-textile industry.

South American Zoo, by Victor Von Hagen; illustrations by Francis Lee Jaques. 182 pp., illus. Julian Messner, Inc., New York, 1946. The author gives a series of short sketches of the animal inhabitants of South America. Among them are: the wool-yielding vicuña of the high Andes; the llama, which he calls "Ship of the Andes"; the cormorant, the bird that produces the guano so valuable to Peru; the armadillo, called "Pampas Tank"; the peccaries, which are herds of "small, clean, gray-black wild pigs"; "His Spotted Majesty" the jaguar; the "Upside-down" sloth, hanging to a bough, asleep "as all respectable sloths are in the daytime"; the various kinds of monkeys, which make up the "monkey business" of the forest; the snakes, the birds, and all the other animals that live in the Andes, the treeless, wind-swept pampas, and the hot, humid, dank jungle of South America. The book, a Junior Literary Guild selection, is written especially for young people, but it is enjoyable reading for adults as well. The numerous black-and-white drawings add much informative and decorative value.

Cultura das Orquideas no Brasil, by João Siegfried Decker. 251 pp., illus. Diretoria de Publicidade Agrícola, Secretaria da Agricultura, Indústria, e Comércio do Estado de São Paulo, São Paula, Brasil, 1946. The author discusses the collecting of orchids in jungles and forests in tropical South America, the transportation and care, the starting and culture in an orchid garden; feeding; diseases and insects of orchids; the development of hybrids; and the production of orchids from seed. Nearly two-thirds of the book is devoted to the principal varieties of orchids. It is well illustrated with 125 black and white pictures, 15 colored pictures of the most beautiful orchids, and 10 drawings.

The Livestock Industry of Nicaragua, by Samuel H. Work and Leo R. Smith. 49 pp., illus., processed. Foreign Agriculture Report No. 12, Office of Foreign Agricultural Relations, U. S. Department of Agriculture, Washington, D. C., 1946. The authors discuss: The scope of the industry; geography of livestock regions; feed situation; cattle, equine animals, swine, sheep, goats, poultry; financial assistance to stockmen: marketing meat animals and meat; byproducts of livestock; prospects for development of the industry.

Fats and Oils—World Production and Trade, by Fred J. Rossiter, Regina H. Boyle, Douglas M. Crawford, Dale E. Farringer, Helen Francis. 130 pp., maps, charts, and tables, processed. Foreign Agriculture Report No. 11, Foreign Agricultural Relations, U. S. Department of Agriculture, Washington, D. C., 1946. The authors show production and world trade in the commodities: Edible vegetable oils—Cottonseed, peanut, soybean, sunflower seed, olive, sesame seed; palm oils—coconut, palm and kernel, babassú kernel; industrial oils—linseed (flaxseed), castor, rapeseed, tung, oiticica, perilla; animal fats; marine oils. An appendix furnishes classification of fats and oils, conversion factors, and United States import duties.

The Argentine Tobacco Industry, by Franklin S. Everts. 21 pp., tables, processed. Foreign Agriculture Report No. 13, Office of Foreign Agricultural Relations, U. S. Department of Agriculture, Washington, D. C., 1946. The author discusses: The production in Argentina of the native and foreign-seed types of tobacco; trade; consumption.

EDITOR'S NOTE.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS **O. R. CARRINGTON, EDITOR**

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Gifts of the Americas

BRAZILIAN BOIS DE ROSE

by **BEATRICE DU FRANE**

Being a mere youth in the ancient family of essential oils—a family that had its beginning in the days of the early Egyptians—Brazilian Bois de Rose oil has endured a succession of growing pains during its 30-odd years of development.

Overproduction, competition, and declining prices plagued the infant industry, all but destroying it, until in 1932 the State of Amazonas undertook by law to protect and assist the struggling newcomer. Eventually governmental assistance culminated in the establishment of the *Consorcio dos Extractores de Essencias Vegetaes.* This organization, popularly known as the *Consorcio,* controls production, exports, and prices in cooperation with the government.

Bois de Rose oil is obtained from the wood of a tree classified botanically as *Aniba rosaeodora* var. *amazonica* Ducke, a relative of the rosewood tree found in French Guiana. Its wood is gray or light yellow.

The tree grows wild in the more elevated areas along the tributaries on the south bank of the lower Amazon River in the States of Pará and Amazonas. Curiously, the tree is not found on the north bank of the Amazon.

In the inaccessible, wild region where the fragrant rosewood trees flourish, nature seems determined on maintaining the *status quo.* She strews privations and disease in the path of those who dare to exploit her kingdom. As a result, it is almost impossible to employ ordinary laborers willing to penetrate the jungles and risk health and comfort for months at a time. Instead, groups of qualified woodsmen, equipped with food and supplies, plunge into the inhospitable jungle and defy nature in her own stronghold.

With water the only means of transporting the logs to distilleries, cutting and shipping of the trees must be timed with the rise and fall of the river. The trees are felled during the months, June–December, when the water level is low, although the yield of oil is not restricted to that period. It is imperative, however, that full advantage be taken of the high-water period, January–June, to ship the logs to distilleries. Since the wood is heavier than water, it must be carried on lighters when high water penetrates sufficiently into the deep woods to permit their use. Only the trunks and large branches are transported.

Unrestricted exploitation of the rosewood tree intensified the hardships of the woodsmen by necessitating even deeper penetration into the jungle. The government, working with the *Consorcio,* came to the rescue again. A law was passed which requires that a new tree be planted under the supervision of a government inspector for about every 45 pounds of oil exported by a distillery. The plantings should preferably be made in rows on cleared jungle land. Young, wild-growing trees may be used for this purpose. When they attain the age of 10 to 15 years, these trees will be ready for cutting.

Bois de Rose oil is distilled at Itacoatiara, Manaos, Barreirinhas, and Maues. The distilleries are located on river banks, and each distillery operates several stills. The rosewood logs are reduced to chips in sawmills equipped with rotary cutting devices, and the chips are then taken to the stills. Distillation is performed without delay in either galvanized iron or copper stills. Stills are capable of handling from about 440 to 1,100 pounds of chips. Approximately 2½ hours are required to process 1,100 pounds of chips. Distillation waters are not re-used. However, the plant material remaining after distillation serves an additional function. After being dried in the sun, it is mixed with firewood and used as fuel. Distilleries ordinarily perform two distillations each day.

The yield of oil averages about 1 percent. More than two-thirds of Brazil's Bois de Rose oil is produced in the State of Amazonas; the remainder comes from the State of Pará.

Bois de Rose oil, which is similar to Mexican linaloe oil, is used mainly in fragrant soaps, cosmetics, and perfumes. The oil is also prized for the linaloöl it contains, which is used in fine perfumes. In another form, the linaloöl may be used in food and beverage flavors.

Annual production of Bois de Rose oil in Brazil averages about 80 tons. In every segment of the industry, the ever-watchful *Consorcio* operates, seeking to keep production, prices, and supplies at levels that will best serve the requirements of both producers and consumers.

RIVERS OF NICARAGUA

(*Continued from page 17*)

were in the lowland agricultural region of western Nicaragua, extending from Lake Nicaragua to the Gulf of Fonseca. Some are grown in the highlands, and smaller amounts in the Escondido and Coco River valleys in an attempt to feed the rubber-plantation workers.

Coffee ranks third in acreage. In 1943 about 73,000 acres were in coffee trees. It is the principal source of income for the higher-income people and provides employment for thousands of the lower-income groups. Seventy-five percent of Nicaragua's coffee comes from the Matagalpa-Jinotega-Nueva Segovia region between the Honduran border and Lake Managua at an elevation of over 3,000 feet.

Rice acreage amounts to about 60,000 acres, more than half of it in the areas adjoining the cities of Managua, Masaya, and Jinotepe. Some rice is grown in the western Departments of León, Granada, and Chinandega, and in the east on the Escondido and Coco Rivers.

Sesame, a new crop for Nicaragua, is grown successfully in the western lowlands. In 1943 there were about 19,000 acres.

Other crops, grown principally in the western lowlands, are sorghum, sugarcane, cotton, cacao, tobacco, peanuts, and castorbeans.

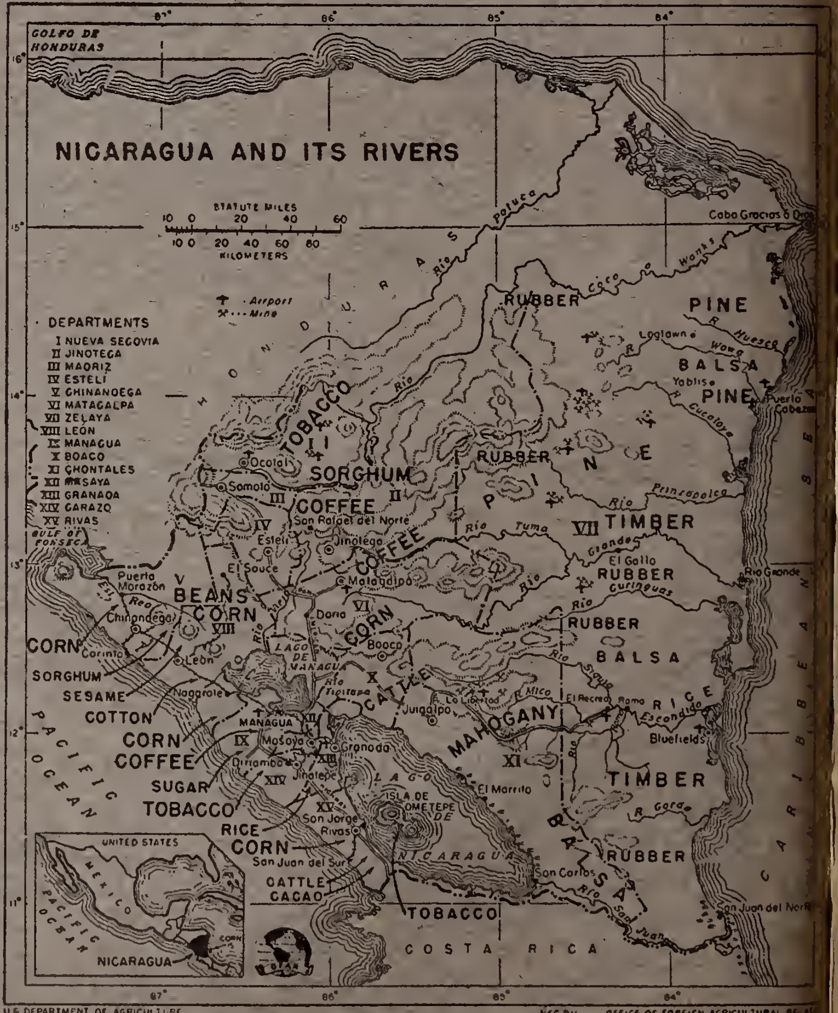
Cattle are raised throughout the western lowlands and central highlands, with smaller numbers in the eastern part. There are practically the same number of cattle in Nicaragua as there are persons. Largest herds are found in the Departments of Chinandega, Rivas, Madriz, and Esteli.

Nicaragua has one railway, the Pacific Railway of Nicaragua, with a total length of 255 miles. Its trunk line extends from the Pacific port of Corinto to Granada on Lake Nicaragua via the principal towns of Chinandega, León, Managua, and Masaya. A few short branch lines connect with smaller towns, and a separate line runs from San Jorge on Lake Nicaragua to San Juan del Sur. The company operates small vessels on Lake Nicaragua connecting Granada and other lake towns once or twice weekly. This lake—San Juan River route provides a means of shipping cargo from western Nicaragua to eastern ports, though it is expensive.

There are about 1,550 miles of highway in western Nicaragua, but in the eastern portion where population is thinly distributed only trails prevail. More highways are under construction in the west-central part. Already a road extends from Managua to Juigalpa and on to El Recreo, which, when it has been finished for all-weather travel, will do much to open up the east.

In recent years airports have been built in several remote and inaccessible places in the jungles of eastern Nicaragua. These made possible the shipment of machinery gold mines and the transportation of men, supplies, and foodstuffs to the rubber-tapping area.

Nicaragua is rich in agricultural land, the development of which depends largely upon increased tra portation facilities on its rivers highways, and airways. A long step forward has been taken in the establishment at El Recreo of the Cooperative Agricultural Experiment Station, for the purpose of developing many necessary tropical plants such as rubber, abacá, jute, derris, African oil palm, soybeans, pepper, sesame, and vanilla.



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February 1947

NAMES & NEWS

Albert L. Delisle Will Teach in Colombia

Albert L. Delisle, Assistant Professor of Biology, William and Mary College, Williamsburg, Va., has received a grant-in-aid from the U. S. Department of State, to serve as Head of the Department of Botany at the National College of Agriculture, Medellín, Colombia. Dr. Delisle, who was awarded the Atkins Fellowship for travel in Cuba and Panama by Harvard University in 1937, is the author of many publications on vegetative propagation of plants, cytogenetics, and morphology and taxonomy of plants. He will remain in Colombia 1 year.

●

T. Lynn Smith Honored by Brazil

T. Lynn Smith, Head of the Sociology Department, Louisiana State University, recently had the degree of Doctor *Honoris Causa* conferred upon him by the University of Brazil in recognition of his extensive sociological studies in that country. Dr. Smith taught at the University of Brazil last summer and is the author of a new publication *Brazil: People and Institutions,* which has been recently translated into Portuguese.

●

Crawford and Stedman Leave for Pacific Area

Douglas M. Crawford and *James W. J. Stedman,* Fats and Oils Branch, PMA, have been assigned to the Pacific Island area to work on various problems of copra production and procurement under the copra agreement of the U. S. Commodity Credit Corporation. Mr. Crawford has gone to the Netherlands East Indies, where he will work with representatives of the Netherlands East Indies Government. Mr. Stedman has gone to the Philippine Islands to serve the Commodity Credit Corporation in a similar capacity.

Robert L. Fowler Returns to Ecuador

Robert L. Fowler, Horticulturist, OFAR, who is conducting research work with cacao at the Cooperative Agricultural Experiment Station, Pichilingue, Ecuador, will return to Ecuador soon following a period of annual leave in the United States. During his stay in this country Dr. Fowler visited several chocolate-manufacturing plants, and a number of experiment stations in the Southern States. On his return trip to South America he will visit the cacao-growing regions of Mexico, Costa Rica, and Panama.

●

Horn and Pope Return From Central American Trip

Claud L. Horn, Head of the Complementary Crops Division, and *Otis A. Pope,* Biometrician, OFAR, have returned from an extended trip to El Salvador, Guatemala, and Cuba, where they inspected special research projects being carried on in those countries. They were impressed especially with the work in Cuba with kenaf. This may be instrumental in establishing for that country a new industry in the production of sugar bags.

●

John R. Parker Goes to Argentina

John R. Parker, Entomologist, U. S. Bureau of Entomology and Plant Quarantine, has gone to Argentina, under Public Law 63, to give technical assistance to that country in the control of a severe grasshopper plague.

●

L. A. Kirkcaldy in U. S. For Special Training

L. A. Kirkcaldy, Education and Extension Officer, Agricultural Loan Societies Board, Kingston, Jamaica, is spending a year in the United States. He will take special training in agricultural credit and farmers' cooperatives. His visit is sponsored by the Jamaican Government.

Agriculture IN THE *Americas*

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Agricultural Colonization In Eastern Nicaragua

These suggestions for agricultural colonization were written at the request of the Minister of Agriculture of Nicaragua to assist him in the formulation of colonization policy, and they are intended to apply to specific conditions in that country. They may furnish, however, suggestions for consideration in similar projects elsewhere.

by LEWIS E. LONG

Agricultural colonization in that part of Nicaragua which is east of the Continental Divide is a matter of considerable concern to the Ministry of Agriculture and to all others interested in the agricultural development of that Republic. The suggestions set forth in this paper may cause some discussion. Additional viewpoints may be called forth which will prove helpful. In any case, readers are asked to remember that these recommendations are intended to apply to specific conditions—those of eastern Nicaragua.

There are three essentials for an agricultural colonization project. They have to do with the quality

Coastal country of East Nicaragua, with Bluefields in the background.

Mahogany is one of Nicaragua's important export products. These logs are being floated down the Escondido River to the ocean. Later they will be loaded on ships for the United States.

and quantity of land available, the nature of the colonists, and markets for salable products, necessitating means of transportation to an established market outlet. In addition, certain matters of policy must be considered in planning the undertaking, such as the contract between the colonists and the colonizing agency, the type of settlement which is to be established, the security of the colonists; and the extent to which the colonizing agency will sponsor cooperative efforts of the colonists.

Suitable Land the First Requirement

Possession of suitable land is the basis of any successful colonization project. In the quality of land natural fertility is the first factor. Land to be used in the project should be reasonably fertile and well drained. Drainage is influenced by the topography of the land and the soil texture. Where land must be artificially drained, the costs of such operations may be too high to justify the undertaking. Land having steep slopes is often unsuitable for annual crops because of a tendency to erode. To prevent erosion with terraces involves costs which may be more than the crops grown will repay. Only in rare cases can an area of land large enough for a farm be found which does not consist of several classes of soil and areas possessing various degrees of slope. The aim should be to allot each colonist sufficient land of the several qualities to permit him to produce a variety of crop and livestock commodities in order to provide well for his own needs and to have some to sell.

In determining the quantity of land to be allotted, the colonizing agency should be generous, especially where land is plentiful and cheap and where the methods of best usage and conservation have not been determined. The colonist should have sufficient land to shift his annual crops to new land frequently, permitting nature to restore the fertility by vigorous growth of deep-rooted plants bringing plant food from the lower soil levels to the surface to be available for the annual crop when the wild plants are destroyed. The age-old tropical custom of cutting the bush, growing two or three annual crops, and then shifting to a new area is based on successful experience and should not be drastically changed, in the wet Tropics, until better methods have been definitely proved. To provide for such shifting, ample land should be allotted.

A further benefit of allotting ample land is that land may be sufficient as families increase in size and more labor becomes available. Possibly on the death of the colonist methods and types of farming would be so changed that the original grant of land could provide farms for two sons or daughters, thus keeping them in the community.

Selection of Colonists

Colonists should be carefully selected. Their health should be good. The enterprise calls for hard work and much sacrifice, and medical facilities will probably be few. Men and women who have passed the prime of life would not be suitable. If such persons have not yet established themselves in a settled position, it is frequently because of lack of industry or poor management, and their chances of succeeding as colonists are not good. All colonists should be married, and young married couples with no children or with children below school age are preferable. This gives time to establish homes and farms and for the colonists to become acquainted before the need for a school arises.

Good character is essential. No habitual drunkards, gamblers, or other undesirable persons should be selected. Colonists should be intelligent, not necessarily educated, but able to appreciate good advice and to cooperate with the colonizing agency and with each other. They should be honest and industrious, willing to work hard to establish a home and improve their community. Finally, they should be of a pioneering spirit, willing to live in the colony

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Lewis E. Long is Director of the *Servicio Técnico Agrícola de Nicaragua,* one of the agricultural experiment stations operated by the Office of Foreign Agricultural Relations, USDA, in cooperation with Latin American Republics.

even though living conditions are hard in the early years of the undertaking, and possessing vision and determination to make from the resources at hand, through hard work, a desirable community in which to live.

Policy of Contract Between Colonists and Agency

If the colony is to develop, the colonists must be able to sell their products. To do this, they must have a market, and, since markets cannot be established without an outlet, the question resolves itself into either locating the colony near existing transportation to a market or building a transportation system. There can be no development without expenditure of funds. Since the colonists will probably have little money, the colonizing agency must supply the funds, either as a gift or as a loan. If as a loan, it can be repaid and further improvements made only if the colonists can sell what they produce. For the east coast of Nicaragua, it is probable that, if suitable land cannot be found along a navigable stream or along the highway now under construction, a colonization project would not be feasible.

The author (right) explains rubber nursery practices to a staff member at the *Servicio Técnico Agrícola* at Cukra in Eastern Nicaragua.

A typical farm family of Eastern Nicaragua.

The interest of the government, which we may assume to be the colonizing agency, is the welfare of all the people. The colonists comprise only an extremely small percentage of the people. Therefore the government may provide gratis only those things which it normally provides gratis for its people, such as protection, possibly schools, and in addition something in return for those things which benefit the general public. Such a benefit might be an assured supply of a commodity which otherwise would be scarce and therefore expensive. The precise amount which the government mignt supply gratis without being unduly criticized is difficult to determine.

The colonist needs land and minimum improvements. The government has land now unproductive and, hence, of little or no value. This land may be given to the colonist gratis because its development adds to the national wealth to the same extent that it adds to the wealth of the colonist.

Minimum improvement may be provided by the government as a loan to be repaid in cash, in public work, in commodities, or in some other manner. These improvements include an adequate water supply, certain buildings, and fences. In general, these should be limited to such improvements as are necessary for the health of the colonists and the efficient operation of the farms and are desired to the extent of willingness to pay for them either in work or cash. Since they are provided in the form of a loan and not as a gift, their cost should be held to a minimum. Insofar as possible, the goal should be such that local materials and colonist labor may be used.

The colony should be recognized from the beginning as a pioneering enterprise rather than an attempt to build a modern community in the bush. It must be a cooperative project in which the government provides the land, minimum improvements, and direction, and the colonists provide the labor.

Unless a certain amount of cash were made a prerequisite, colonists would probably be unable to finance themselves until a crop could be produced. If families without funds are accepted, the colonizing agency might provide the means for moving to the project and for living until an income from farming is assured. This might be in the form of a loan, commissary credit, or as wages paid for work in developing the colony or in constructing a highway, if the colony is located along such a project.

To protect the interests of the general public, the contract should provide that the colonist live on and improve the land allotted to him for a stated period before being given a complete title to it. He might also be required to plant and care for a given acreage of government-owned forest land in return for the minimum improvements. Or such forest land might be allotted to the colonist with an agreement that he would share in the proceeds from the sale of the timber when cut at the termination of 20 to 30 years, provided he is still in possession of the land. Should he sell the land, all timber would remain the property of the government. The government would, perhaps, provide planting material in order to obtain uniformity of species and to regulate the rate of planting.

Provision should be made whereby a certain number of doctors, teachers, lawyers, and skilled laborers would be attracted to the community. These might be given a grant of land without the requirement of planting and caring for the forest trees, but in any case they should be required to remain in and serve the community in return for any concession granted.

A group of Nicaraguan farmers discuss various problems with representatives of the experiment station at Bluefields.

As the government would have a definite interest in the colony both from the standpoint of an investment and the interest of the colonists, an able man, together with the necessary help, should be provided to manage the colony, keep the accounts for the government, provide agricultural and commercial advice for the colonists in their undertakings, assist them in organizing for cooperative undertakings, and work generally for the success of the colony.

Type of Settlement

A matter to be determined early in the planning is the type of settlement to be set up. It may be in the form of a village with the farms surrounding it, or each farm may have its own buildings. A village is bound to spring up as a trading center. Having all families live in a village facilitates the providing of a school, church, water, electricity, and other desirable features. On the other hand, having the homes on the individual farms permits closer care of the crops and livestock and gives more privacy. Perhaps the type chosen should conform most nearly to that to which the prospective colonists are accustomed.

Security an Ideal Factor

The government would have still another obligation if a prosperous and happy community is to be assured. The land, as it is improved, must not be allowed to fall into the hands of a few individuals, who would then employ the former owners as laborers or would lease the land to the former owners at excessive rents. The writer cannot suggest the manner of providing such security, unless it be for the government to retain title to the land and grant to the colonist and his heirs the use of it. Even this method has undesirable features. The matter may be considered in planning and some protection may be provided, but, judging from experience in other countries, the ideal condition is too much for which to hope.

The same may be said for the whole colonizing undertaking. Both planning and execution of plans are highly complicated, and the most successful have left much to be desired. Yet, progress is made only by trying. A country with much suitable virgin land and many needy people may well attempt to bring the two together, for the benefit not only of the people colonized but of the country as a whole.

Typical cacao-growing country along the Cauca River in Colombia

Colombia's Chocolate Crop

Although Colombia contributes only 2 percent of the world's supply of cacao, from which chocolate, cocoa, and cocoa butter are manufactured, the industry is important within that country. Colombia is now planning greater production of cacao through replanting, propagation, and a national extension program.

by ROBERT L. FOWLER
and JORGE E. SALINAS

Colombia has the distinction of being one of the few countries in the Western Hemisphere where plantations of Criollo cacao may still be found. Although this tree does not bear heavily, its beans are among the world's finest and, consequently, bring a higher price than other kinds.

Formerly Criollo was cultivated throughout all the areas where conditions were favorable to cacao production. When it became known that another cacao called Forastero possessed more resistance to drought and disease and came into production within 3 or 4 years after planting, in contrast to the 6 or 7 years required by Criollo, plantation owners began planting Forastero in order to secure quicker profits.

Despite its hardier characteristics, Forastero is a hybrid, which produces beans lacking in uniformity and inferior to Criollo. Regarding pod shapes, Forastero pods grade from smooth round pods, which are low-quality cacao, to deeply warty, furrowed, and

Cacao pods are produced on the trunk and branches of the trees. Pods of superior-quality cacao are deeply warty, furrowed, and pointed.

pointed pods, which are of superior quality, externally resembling Criollo. For market purposes the lower-quality Forastero types are called Calabacillo to distinguish them from Criollo Nacional or Real. Locally the low-quality cacao is called collectively Pajarito. Higher qualities are known as Caucano in the Turbo region, and as Hartón, Argentino, Antillano, and Injerto in the Cauca River Valley. Unfortunately not much thought was given to the quality of Forastero introduced, and in many regions a very inferior type now predominates. Today estimates indicate that 90 percent of Colombia's cacao is Forastero.

Cauca Valley Is Best Producing Area

Although cacao is grown to some extent in the Pacific and Atlantic coastal lowlands, the most important producing areas are along the Cauca and Magdalena Rivers. Small cacao plantations are scattered in the Amazonian region, but from an economic standpoint they are of little importance.

The Cauca Valley, in the region of Cali, possibly offers the greatest potentialities. At present an estimated 40 to 50 percent of Colombia's cacao is grown here, but the region could easily produce enough cacao to meet Colombia's requirements.

This fertile valley, approximately 3,000 feet above the sea, lies between the Central Range of the Cordillera and the Occidental Range. It is about 125 miles long, varying in width from 10 miles at Cartago in the north to about 30 miles at Santander in the south. Annual rainfall averages around 35 inches, and the mean monthly temperature ranges from 65° to 90° F.

Unfortunately rainfall is inadequate for most cultivations, creating a water shortage which constitutes a serious limiting factor to agricultural expansion. Preliminary studies on irrigation are now being carried on by an American company with the cooperation of Dr. Ciro Molina Garcés, Secretary of Agriculture of the Department of Valle del Cauca. With irrigation, thousands of acres of untilled land could be brought under intensive cultivation, and this valley could then produce all the cacao required in Colombia, as well as substantial amounts of sugar, vegetables, fruits, and livestock.

Cultivation of Cacao

Cultivation of cacao in Colombia differs little from methods employed elsewhere in the world. Eight or 10 months before cacao seeds are to be planted, a temporary shade is established with banana plants. Permanent shade trees may be planted at the same time, usually about 40 feet apart. Various species of trees may be used: Pisamo (*Erythrina glauca* Willd.), avocado (*Persea americana* Mill.), caimito (*Chrysophyllum cainito* L.), cedro (*Cedrela odorata* L.), breadfruit (*Artocarpus communis* Forst.), caracoli (*Anacardium excelsum* (H.B.K.) Skeels), jobo (*Spondias mombin* L.), guasamo (*Inga* sp.), and zapote (*Calocarpum mammosum* (L.) Pierre).

Cacao seeds may be planted in nurseries and later transplanted, or planted directly in the field, from 12 to 16 feet apart. Trees require 3 or 4 years for Forastero and 6 to 7 years for Criollo to reach maturity. They grow some 15 feet high. Pods, contain-

Many growers prefer to dry cacao beans on trays which can be moved quickly under shelter.

ing 30 to 40 seeds, are produced on the trunk and branches of the trees. Two crops are produced each year. To maintain the trees in a thrifty condition it is necessary to weed the fields and remove the epiphytes from the trees once or twice a year.

Diseases and pests have caused many cacao plantations to be abandoned. In the Urabá region alone, loss in pods from phytophthora pod rot (*Phytophthora palmivora* Butler) is as much as 70 percent during the height of the infection season. Pod destruction in the region of Garzón is great also. Witches' broom (*Marasmius perniciosus* Stahel) occurs only in the Tumaco region, where 60 percent of the foliage is estimated to be infected. Other branch and fruit diseases occurring in Colombia are die-back (*Diplodia theobromae* (Pat.) Nowell), sphaeronema pod rot (*Sphaeronema* spp.), and anthracnose (*Colletotrichum* spp.). In addition there are root diseases caused by *Rosellinia* spp., *Fomes* spp., and *Sphaerostilbe* spp. Insect pests, rodents, and birds also cause considerable damage.

Another important current problem of cacao cultivation, particularly in the Cauca River Valley, is the destruction of the shade trees *Erythrina* sp. The trees are attacked by beetles which bore into the trunk, making an avenue for infection by certain fungi which cause rapid death of the tree. Leaf-cutting ants are also highly destructive to both the shade and the cacao trees.

Harvesting and Processing

Harvesting occurs twice each year, in July-August and December-January. The ripe pods on the trees are collected and taken either to a convenient spot in the plantation or to a place adjacent to the farm house. Then the pods are opened with a small machete and the seeds, or beans, removed.

The cacao beans are allowed to ferment in large boxes or *canoas*, from 24 to 36 hours for Criollo and from 3 to 4 days for Forastero. This process destroys the viability of the beans and brings about important chemical changes which give cocoa and chocolate their characteristic aromas and qualities. The next process is that of drying in the sun. After this the beans are ready to be transported to market either by muleback or by truck, and are eventually shipped to manufacturers for processing.

Cacao selections are propagated vegetatively by cuttings which have been dipped into a growth-promoting substance to stimulate root formation.

Processing consists of roasting and milling the beans. Roasting is said to be one of the most important processes involved in the manufacturing of chocolate and cocoa. The beans are heated in an oven, usually of the rotation cylindrical type, at temperatures ranging from 100° to 250° F. Temperature and length of time somewhat determine the type and quality of the finished product. The roasting makes easier the later separation of the kernel from the shell or husk.

The roasted beans are crushed between rolls of serrated cones which break up the beans into angular fragments called nibs, and the shells are blown away. The nibs are ground between several pairs of mill stones, each pair being closer set than its predecessor. During this grinding process heat is generated, which melts the cocoa butter, or fat, and a thick chocolate liquid emerges from the mill. When this solidifies, it is known as unsweetened chocolate.

In the manufacture of cocoa the chocolate liquid is poured into circular steel pots, and the cocoa butter is extracted by means of hydraulic pressure. The hard, dry, compressed cocoa that is left is converted into powdered cocoa as we know it by grinding and

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Dr. Fowler is Horticulturist in the Office of Foreign Agricultural Relations, USDA. Mr. Salinas is Chief of the Department of Cacao, Colombian Agricultural Experiment Station, Palmira, Colombia.

Home of cacao grower in the Cauca Valley of Colombia.

sifting. The solidified cocoa butter is placed on the market as cocoa butter, which is used chiefly in the manufacture of confectioneries and to a lesser extent in cosmetics.

Plans for Improving The Cacao Industry

For many years Colombia has imported cacao for home consumption. In 1938, of the 7,754 short tons consumed, only about 4,960 tons were produced, necessitating the importation of a little more than 2,790 short tons. In 1943, production had risen to 8,144 short tons, but at the same time consumption had increased to 11,912 short tons, leaving 3,768 short tons to be imported.

Within the next 5 years or so the Government plans to increase cacao production considerably. The first step will be to improve the general condition of the plantations, which for years have received no care and are now in a state of decadence. The number of trees actually bearing has dropped sharply. For example, in the region of Garzón, of the estimated 2,500,000 trees only 75 percent are in production, as a result of poor cultural practices, disease, and aging of the trees. The 1944 yield of cacao in the Urabá region just south of Turbo was about 20 pounds to an acre, in contrast to 440 pounds in the Cauca River Valley. With their cacao plantations in bad condition, many owners have turned to the production of other crops such as rice, cotton, corn, and sugarcane. A few have engaged in the cattle business and are increasing their acreage of pasture lands.

Since 1938 the National Government has appropriated small sums of money yearly for a cacao-improvement program, involving primarily sanitation and cultivation, which is said to have increased the annual production by 3,197 short tons. Continued improvement of cultural methods is expected to increase production still more, though hardly enough to meet future demands in a country with steadily rising population and increased use of cocoa and chocolate.

Colombia has recently prepared another plan for improving cacao production. It calls for the planting, over a period of 5 years, of 24,710 acres of cacao at an estimated cost of $130 per acre. An additional sum of $91,500 will be made available for the sanitation and improvement of existing plantations. The financing of this program will be done jointly by the *Banco Agrícola Hipotecario* and the *Caja de Crédito Agrario Industrial y Minero*. Research work will be centered at the Palmira Experiment Station, with substations at Pueblo Rico, Garzón, and Sevilla.

The over-all program for the country consists of a selection and propagation study, establishment of model cacao plantations, investigations concerning methods of irrigation, best method and cost of establishing new plantations, and best cultural practices. The plan is to collect cuttings from trees in the country for use as propagating material, which will be rooted in special propagating bins at Palmira. The best of these selections will be used in the rehabilitation program. Already over 500 trees have been selected and vegetative propagation begun.

Provision has been made also for the establishment of a national extension service for cacao. For this program the country has been divided into several zones. Through agronomists, experienced agriculturists, and laborers as intermediaries, the growers in these zones may receive gratis, upon solicitation, all the plant material needed to extend or replant their cacao plantations. Supervision of pruning the trees and aid in disease and pest control will round out the free services offered to the planters, in this extensive program for improving Colombia's cacao industry.

The white potato came originally from Chile and Peru, where the Incas developed it from a sour root hundreds of years before the Spanish came.

* * *

There are more than 2 million persons in the United States whose mother tongue is Spanish or Portuguese, according to the Bureau of Census.

Honduras Trains Rural Teachers

Rural school teachers have a great opportunity to help build a better life for the communities in which they work. Realizing the need of definite training for such work, Honduras recently established a rural normal school, which already is paying dividends in benefits to nearby villages.

by LLOYD H. HUGHES

One of the most significant steps in rural education in Honduras took place in October 1945, when the first rural normal school was established at Toncontín, a small village in the southeastern part of the Republic near the Salvadoran border. The school was organized in compliance with the terms of a cooperative educational agreement signed in 1944 by the Ministry of Education of Honduras and the Inter-American Educational Foundation, Inc.* Much credit for the establishment of the school goes to Dr. Angel G. Hernández, Minister of Education of Honduras, for his long and sustained interest in the improvement of educational facilities in the rural regions of his country.

The importance of this new school becomes apparent when the prevailingly rural character of life and the lack of trained teachers in rural areas in Honduras are taken into consideration. For example, in 1941, the most recent year for which statistics are available, only 959 out of 1,620 elementary school teachers in the country had received any special preparation or training in educational subjects. Rural areas experienced considerable difficulty in securing and holding teachers who were graduates of a normal school, as most of these teachers gravitated toward the cities. It is hoped that within a few years the acute shortage of trained teachers will be diminished in the rural areas of Honduras and that the teacher graduates of the new normal school will be able to lead the rural communities in a better and more satisfying life, not only as teachers but also as agricultural and community leaders.

Under the terms of the cooperative educational agreement the normal school was to be constructed, staffed, and equipped by Honduras, and the Founda-

Students at the new normal school in Honduras spend a part of their time working on the school farm. This group is cultivating a field of peanuts.

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* *See* "Inter-American Educational Foundation and Its Program," by Lloyd H. Hughes in the November 1946 issue of *Agriculture in the Americas.*

Supervised athletics form a regular part of the curriculum at the school.

tion was to supply consultants who would work with the Honduran faculty in the organization of the school and the establishment and development of the curriculum. Honduras has more than complied with the letter and spirit of the agreement.

To date, four main buildings—dormitory, dining room and kitchen, and administration and two classroom buildings—have been constructed and equipped. A number of accessory buildings, including a poultry house, generating plant for electricity, and the necessary farm and equipment sheds have been completed. An adequate water supply system has been installed, carefully tested drinking water coming from the capital, Tegucigalpa, and filtered river water for general purposes brought from a reservoir and filtration plant constructed on a mountainside.

Every possible precaution is taken to protect the health of the students. A school physician makes regular visits to the school twice a week, and complete health examinations and laboratory tests are given to all pupils. A scientific system of sewage disposal has been installed. The dining room and kitchen are screened, and careful attention is given to spraying for insects. Food-storage cellars are thoroughly cleaned daily.

The school is of the *internado*, or boarding school, type, all of the pupils living and taking their meals there. Meals are simple but nutritious.

For recreation there is a good athletic field where the boys play soccer, baseball, and basketball. Soccer is the favorite game, but baseball and basketball are rapidly increasing in popularity. The athletic field is located in a natural amphitheater that is about 100 yards wide and thus large enough for almost any type of team game.

Faculty, Students, and Curriculum

At the present time the school faculty is composed of 12 members. These include Señor Raul Zaldívar, Director of the school and one of Honduras' leading authorities in rural education, and two North Americans—Robert Hurd, Professor of Agricultural Education, and Eric Hurst, Supervisor of Education and Teacher Training. Clay J. Daggett, Special Representative of the Foundation in Honduras, also works closely with the Minister of Education and the Director of the school in the capacity of technical adviser.

The enrollment of the school last June totaled 65. This number included at least two boys from every Department of Honduras, with the exception of one, which was represented by only one boy. About half of the students receive scholarships from the Honduran Government that pay all expenses of tuition, board, and lodging. Scholarships are provided annually to at least two students in each Department based upon competitive examinations given by the Ministry of Education. Tuition for nonscholarship students amounts to $15 (30 *lempiras*) a month. All students are required to supply their own clothing and other articles of personal use, but the school provides medical attention to all students.

Entrance requirements are liberal and can be met by most graduates of rural elementary schools. In order to matriculate, a boy must be in good physical condition, of good moral character, at least 15 and not more than 20 years of age, and a graduate of a 6-year elementary school, and he must be willing to accept a teaching assignment in a rural school after completing his training. Average age of students is a little over 16 years. All candidates must pass health, preparation, and aptitude tests.

The school year is divided into two semesters of 5 months each. The first semester runs from May

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Mr. Hughes is associated with the Office for the Inter-American Educational Foundation, Inc., Washington, D. C.

through September, the second from November through March, the schedule followed in all the rural schools of Honduras. School is not in session during October or April.

Because the principal rural activity in Honduras is agriculture, agricultural education, *economía rural*, forms the core of the curriculum, and instruction in all other subjects is related to and correlated with it. Work in agricultural education includes study of crops, soils, agricultural methods and techniques, irrigation, animal husbandry, and manual activities related to farming. During the entire course of 3 years the curriculum includes, for each week, 3 hours each of Spanish, mathematics, geography and history of Honduras, Central America, or the world, physical, chemical, or natural science, music and music appreciation, and physical education and sports; 6 hours of introduction to education, educational psychology, or general methods; 2 hours of drawing; and 20 hours of agricultural education.

School Already Proving Its Worth

The objective of the rural normal school is the training of teachers and community leaders for service in the rural areas of Honduras. Teachers graduated from the school will be prepared, it is hoped, not only to teach the elementary school subjects but also to act as community leaders, agricultural agents, and channels of contact between the Ministry of Education and the communities.

The program developed at Las Casitas is an example of how the school is already working actively with surrounding villages to improve rural life. Las Casitas is a community of 150 inhabitants about 3 miles from the school campus. Last June, 28 students of the second-year class went to this village to see what they could do to improve life for the people living there.

They arrived shortly after a drowning accident which demonstrated the need for a knowledge of artificial respiration. The students organized instruction in artificial respiration and first aid, and a sufficient number of villagers took advantage of the opportunity for this training so that a recurrence of similar tragedies might be prevented.

The boys noted that all water for the village was carried by women from a spring 500 yards from the village. They discussed with village leaders ways of raising the water to a sufficient height so it would flow to the village in a wooden trough, and methods of filtering and purifying the water. The assistance of the *Servicio Cooperativo Interamericano de Salúd Pública* was enlisted to carry out the project.

Students of the normal school receive training in artificial respiration.

Corn and beans constituted 90 percent of the agricultural produce of the village, because the ravages of umbrella ants and other pests had discouraged the raising of different vegetables. The class agreed to help the villagers fight these pests, to assist in the introduction of soybeans, tomatoes, and citrus fruits, and to investigate the possibilities of producing more than one annual crop and supplying much-needed water for irrigation.

Although the children of school age in Las Casitas and the environs numbered at least more than a hundred, the village school had only 18 pupils. In order to invite a larger enrollment, the class decided to supply the materials and books which the school needed, to give in-service training in methods and subject matter to the local teacher, and, if necessary, to assign students of the normal school to assist in the instruction.

This same type of project will be undertaken later in other villages. In this way the normal school students will become familiar with village organization, structure, and problems, and will have a real opportunity to learn ways of participating in the solution of community problems and helping to raise the level of rural life in Honduras.

La Zafra—Cuba's Sugarcane Harvest

In Cuba the dry season, la seca, *creeps through the months from November to April. Nature rests, after the growth of the rainy season, but for man it is* la zafra, *sugarcane harvest, which brings all Cuba into its highest pitch of activity.*

by LOWRY NELSON

As October approaches and the rains, which have been falling almost every day since May, become less and less frequent, the well-soaked soil begins to dry. All over Cuba there is a murmur of anticipation and activity. Nature's period of growth is over, and it is time for *la cosecha*, the harvest, and man's activity.

Up in the coffee country red berries on some of the earlier-maturing coffee trees tell the planter that preparations for harvest must be made. Workers are to be engaged, likely as not the same ones who were there the year before. Necessary supplies, picking baskets, and all equipment must be checked and repaired where necessary. Rice and the other supplies of food have to be arranged for, to feed the heavy-eating wage hands.

During October and November tobacco farmers transplant the seedlings which were placed in the seedbeds in August and September. The tobacco harvest season will not be long delayed, for tobacco requires only 55 days to mature.

On the sugar plantations, *colonos* inspect the cane and the wetness of the soil. Mill owners rush the

Courtesy of Sugar Research Foundation, Inc.

A hundred thousand machetes in the hands of a hundred thousand men are needed to cut the millions of tons of sugarcane grown in Cuba.

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Agriculture in the Americas

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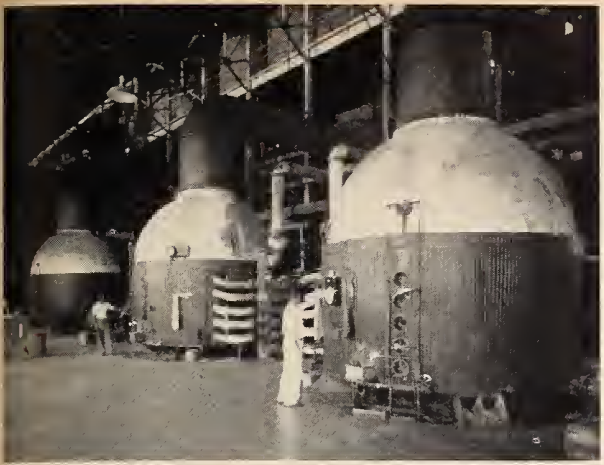

In the process of refining, sugarcane juice is cooked in these giant boilers.

final repairs on the mills. Arrangements are made to supply labor for the season's work. By January 1 most of the sugar *centrales* are ready to fire the boilers and begin the feverish activity that will last for some mills until the first of June, or even later.

Exciting Activity Of Cane-Harvest Time

La zafra! What connotations the word has for Cuba! For it, hundreds of thousands of black slaves were brought from Africa. And after the emancipation of the slaves, came free black men from Haiti and Jamaica each year, with their pitiful packs of belongings and their *hamacas* for sleeping, to feed the huge maw that was and is the *zafra*. In the Cuba of 1946–47 thousands of Cubans throng the highways, the railroads, and the byways to get to the mills, to the sugarcane plantations, for the *zafra*.

Millions and tens of millions of tons of cane have to be cut. A hundred thousand machetes in the hands of a hundred thousand men will do the cutting. Each stalk will be held in a human hand for a few seconds as the machete in the other hand cuts it at the bottom and deftly trims the leaves before the stalk is thrown on a pile of other stalks.

Then these millions of tons of stalks must be lifted by sweating human bodies into *carretas*, the large two-wheel carts which patient, sturdy oxen will draw to the mill or to the railroad spur. The power exerted by men and oxen in the *zafra* is a stupendous sum of energy. It is hard work, often gruelling for both man and beast, for Cuba has taken few steps to relegate this burden to machines.

Money flows through Cuba in great quantities and at an accelerated pace during the *zafra*. Workers who, during the *tiempo muerto*, or inactive rainy season, ate sugarcane and bananas or other home-grown fruits and vegetables now clamor for the luxury of rice, lard, and oil. There is money now to pay the grocer, who charged the grocery account of the family after the money from the last *zafra* ran out. The grocer, in turn, will pay the wholesaler and the banker. Mill owners, *colonos*, merchants, big and little, pay back the money they borrowed during their inactive season. Railroads put on extra helpers to handle the increased freight—bringing supplies to the *centrales* and to merchants in the towns who anticipate the expanding demand, taking the cane to the mills from the most distant points, and hauling the sugar to the ports. Ports take on new activity, as do the ships that freight the raw sugar to the refineries of the United States and Europe.

The surging articulation of nearly half a million men with their oxen, their carts, their railroads, their huge grinding mills; vast movements of men and of women from their homes to the cane fields; the heat; the sweat; the fatigue of the long days of cutting

Courtesy of Sugar Research Foundation, Inc.

Sturdy, patient oxen haul the cane to mills or railroads in high two-wheel carts called *carretas*.

Dr. Nelson is Professor of Sociology at the University of Minnesota and Rural Sociologist of the Minnesota Agricultural Experiment Station. He is the author of a number of books and articles on rural sociology.

Reading about the AMERICAS

The Masters and the Slaves, by Gilberto Freyre; translation into English by Samuel Putnam from the Portuguese (1933) *Casa-Grande e Senzala*. 537 pp. Alfred A. Knopf, New York, N. Y., 1946. Published simultaneously in Canada by The Ryerson Press. In *Casa-Grande e Senzala*, which translated literally means The Big House and the Slave Hut, the author presents a sociological study of Brazil. Brazilian economy, depending first upon sugar, later upon coffee, fostered the accumulation of large land holdings. Three chief elements of Brazil's population are considered—the Portuguese conqueror, the aboriginal Indian, and the imported Negro. Social and religious relationships are discussed in detail. A glossary of Brazilian terms, an extensive bibliography, and diagrams of the Big House of the Noruega Plantation in Pernambuco are included.

Palmáceas do Brasil, by Claudio Cecil Poland, 55 pp., illus. Serviço Florestal, Jardim Botânico, Brasil, 1945. Pictures, descriptions, common names, and habitats of 23 palms of Brazil make up this Volume I, issued by the Superintendent of the Botanical Garden at Rio de Janeiro.

Insectos Útiles a la Agricultura, by Ubaldo López Cristóbal. 192 pp., illus. Enciclopedia Agronómica, Vol. 29, Buenos Aires, Argentina, 1945. An entomological manual of insects which act as parasites of others and thus prove useful to agriculture.

Our Son Pablo, by Alvin and Darley Gordon. 235 pp., illus. Whittlesey House, McGraw-Hill Book Company, New York, 1946. The Gordons met Pablo, a 21-year-old Tarascan Indian, when they were in Michoacán filming the documentary movie "Mexico Builds a Democracy." Pablo had a great desire to "bring his people into the national picture of Mexico, to help them participate in Mexico's democracy." The Gordons took him home to California with them. Pablo's adjusting to life in the United States, his 2 years in the University of California, and his struggle to grasp the principles of democracy make an interesting, often amusing, experiment in real Good Neighborliness. After his return to continue his studies in the University of Mexico, "Mama and Papa" Gordon visited him there and in his home in Charapan, a little town in the shadow of Paricutín. They portray vividly the wonder and terror of that volcano and the devastation wrought by it to the farms and animal life for miles around. In *Our Son Pablo* the authors have "drawn the reader into the Pablo experiment, into his problems . . . and so into an understanding of the greatest problem that lies before this nation and our world: the problem of what we call—and what we have made—the minority groups."

Maryknoll Mission Letters. Volume 1, 1946. 63 pp. Field Afar Press, New York, N. Y., 1946. One group of the letters are from Maryknoll missioners interned during the war in Asia. Another group come from missioners in Mexico, Guatemala, Bolivia, Chile, Peru, and Ecuador. Through these letters we learn much of the life in the various countries.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications write direct to the publishing agency given in each case.

(Continued from page 35)

and loading cane; the disappointments and the defeats; the joys at the new-found activity; satisfactions of wants long delayed, now made possible; the meeting of old friends not seen since the previous *zafra;* fiestas in the towns—all these make the cane harvest the major event of the Cuban year.

After the Zafra, Again the Tiempo Muerto

Then again the rains begin; once more it is the *tiempo muerto*, the season when nature works and man settles back into relative inactivity. For the cane farmer there are only minor tasks to do, such as chopping the weeds in the cane rows, planting and caring for the vegetable gardens to feed his family. Mostly this is work for only the year-round labor force; with the advent of the rains, the temporary workers go back to the places from which they came. The tobacco farmer works in his shed, sorting, grading, curing, baling, and shipping his tobacco to market, but it is not a rush season. Coffee trees need little or no attention until the berries are ripe for the harvest in October or November. It is a time of waiting for plants to grow and mature and for the rains to cease. Only the dairy farmer must continue to milk his cows and care for his herd.

But in the never-ending cycle of seasons the rains will again fall less and less frequently, and once more Cuba will throb with the activity of *la zafra*.

RIVERS OF PUERTO RICO

by KATHRYN H. WYLIE

More than 1,300 rivers and small streams enrich the agriculture of Puerto Rico, the smallest island of the Greater Antilles, lying at the eastern edge of the Spanish Main. This oblong island, 95 miles long by 35 miles wide, is divided into two drainage areas by the Central Cordillera, which crosses it in an east-west direction. This range, together with an irregular series of formations of lesser extent, produces rugged country in all except the coastal lowlands. In fact, Puerto Rico, in common with other nearby islands, is the top of a mountain chain now almost wholly submerged beneath the ocean.

These mountains are the source of the rivers, and their uneven topography produces many beautiful waterfalls which are useful as sources of power. Most of the streams are shallow and are not navigable except for short distances by small boats at high tide. They overflow easily in the rainy seasons and inundate part of the surrounding country. Because of the erosion of the limestone formation there is much underground drainage, rivers disappearing into sinkholes and then sometimes reappearing farther on to empty into the sea.

Since the central range is much closer to the southern than to the northern shore, the rivers south of the mountains are short and maintain their independence until they reach the sea. The rivers to the north, on the other hand, are inclined to consolidate into larger drainage systems, such as the Guajataca, Arecibo, Manatí, La Plata, Bayamón, and Loíza. In the northwestern part of the island, for example, 20 streams originate in the uplands but only 6 of them flow across the lowlands to the coast. Eleven of the 20 are absorbed by the Arecibo and Manatí rivers, two of the larger rivers that influence the agriculture of the valleys through which they flow.

To the northeast the Loíza River rises in the Cerro Gordo in the Humacao District and crosses the San Juan District picking up other streams and brooks on its way. Its bed covers an estimated 250,000 acres. The Plata River, also flowing north, provides water for the reservoir at Carite, which is one of the most useful dams for the irrigation of the south coast. Of the short rivers flowing south from the Cordillera the principal ones are the Yauco, Cañas, Jacaguas, Descalabrado, and Portugués, in the District of Ponce; the Salina, Guamaní, and Patillas in Guayama; and the Guayanés in the District of Humacao.

Besides the two principal drainage areas, there is a watershed on the western side. The two important rivers there are the Culebrinas and the Añasco. Columbus is supposed to have entered the first of these rivers when he discovered the island in 1493.

At that time the island was covered with heavy tropical forests which have since been largely cut away to make room for cultivated crops. Compared with other areas of the New World the conquerors found little in the way of mineral resources that could be exploited for quick fortune. They were able, however, to obtain substantial quantities of gold from river placers. There are also small deposits of manganese, magnetic iron, salt, and coal. Although much of the valuable timber has been cut, there is still a wide variety of plant life including bamboo, coconut and other palms, cedar, ebony, calabash, boxwood, and logwood. Among the fruits are avocado, orange, lemon, lime, grapefruit, papaya, mango, and banana. In addition, there are numerous cultivated crops including sugarcane, tobacco, coffee, yuca, beans, corn, and rice.

Columbus and his followers found an equable tropical climate modified pleasantly by the easterly trade winds that blow almost constantly. The temperature in the capital city of San Juan ranges from a minimum of 62° to a maximum of 94° F. Average monthly range is from 67.8° to 87.8° F. In the interior, however, there is a much wider range of temperature because of the mountainous terrain. Average rainfall for the island is 69.2 inches, but it is much heavier north of the central mountains than it is to the south. On El Yunque Mountain, in the north, for example, the average annual rainfall runs as high as 209 inches, whereas at Ensenada near Guanica in the southwest it is only 29 inches.

In order to bring into production the otherwise barren soils of the southern coast, a system of irrigation is already operating and in process of expansion. In some places the abundant rainfall of the north is collected and tunneled through the mountains into the dry areas of the south. The most extensive projects reach from the Patillas River to the Jacaguas River on the southeast coast of the island and water more than 50,000 acres.

Of the more than 2,000,000 people now living in Puerto Rico about two-thirds are descendants of the Spanish settlers, 5 percent are Negroes, and the rest Mulattoes. The Indians, or Borinqueños as they were called, living on the island when the Spaniards arrived were almost entirely eliminated. An exploratory trip made by Captain Juan Ponce de León in 1508 was followed the next year by a small group of Spanish colonizers. Although colonization was not spectacular in the early days, it continued steadily and the island became one of Spain's leading colonies during the nineteenth century. At the close of the Spanish American War in 1898 the island was ceded to the United States. Population has increased rapidly until

(*Continued on back cover*)

ALONG THE *Agricultural Front*

▲Panama's National School of Agriculture Graduates Third Class

Last fall the National School of Agriculture of Panama, located at Divisa, in the Province of Herrera, graduated its third class. Twenty-four young agriculturists from all the Provinces of the Republic who had completed their 2-year course received diplomas. President Jiménez presented the diplomas. Addresses were delivered by Dr. Menalco Solis, Director of the School and of the National *Instituto*, and by Secretary Alfonso Tejeira of Agriculture and Commerce. Several members of the President's Cabinet and leading agriculturists from all the central Provinces were in attendance.

The school's experimental farm is carrying out important work in the cultivation of rice and vegetables, in the breeding of cattle and poultry, and in the production of other foods.

Scholarships are being arranged for graduates of the school to study in the United States, Peru, and Mexico so that they may develop into agronomists who can act as teachers and advisers to the farmers of the Republic.

▲ Venezuela Encourages Farm Cooperatives

To increase production of agricultural commodities, the Venezuelan Government has begun an active campaign to establish farmer cooperatives within the country. Following establishment of six cooperatives in the State of Zulia, the Government plans to provide each with an agricultural agent, similar to a county agent in the United States. Federal bank loans will be available to the members of the co-ops for purchase of implements, seed, and breeding stock.

▲Indian Cattle Imported to U. S. for Dairy Cattle Experiment

Two young Indian bulls and two heifers, outstanding representatives of the Red Sindhi breed, have arrived at the Beltsville, Md., Dairy Experiment Station. They will be used to start a USDA long-time breeding experiment for the development of better dairy cattle for southern climates.

The cattle were obtained by the U. S. Bureau of Dairy Industry from the Agricultural Institute of the American Presbyterian Mission at Allahabad, India, in exchange for two bulls and two heifers from the Bureau's Jersey herd at Beltsville. In general appearance and characteristics the Red Sindhi is similar to other breeds of Indian cattle, with the typical hump, drooping ears, and heavy dewlap. This breed has made high records in milk production at the Allahabad Institute.

Other breeds of Indian cattle have been imported and crossed with American beef breeds and range cattle in the Coastal Plain area of Texas and Louisiana for nearly a century to obtain a hardy, fast-growing type of beef animal. This will be the first attempt in the United States to use an improved dairy strain of Indian cattle to combine the Zebu qualities of resistance to heat, pests, and drought with the domestic Jersey dairy qualities. The imported animals will be kept at Beltsville for a short time and then will be sent to the Department's field station at Jeanerette, La., where the long-time breeding experiment will be conducted.

▲Peru Creates National Food Supply Corporation

Recently the National Congress of Peru enacted a law creating a National Food Supply Corporation. Regulation of prices and improved distribution of food products are the chief purposes of the law, which has long been pending. The Corporation will operate on a nonprofit basis and is authorized to exist until abolished by law.

In order to carry out its objectives, the Corporation is authorized to buy and sell food articles, construct and maintain storage facilities wherever they may be necessary within the country, construct and administer packing plants for meat and fish, promote, construct, and administer milk-pasteurization plants and bakeries, and in general carry out whatever related activities the circumstances justify. The price-fixing operations of the Corporation will be controlled through supreme resolutions initiating with the Minister of Agriculture, setting the limits on the amount of mark-up which the Corporation may charge over and above cost prices and fixing the maximum rates which the Corporation may collect for its various services or operations. Whenever sale prices are fixed below the actual cost of purchases, losses are to be assumed by the Government.

AGRICULTURE IN THE AMERICAS O. R. CARRINGTON, EDITOR

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U. S. GOVERNMENT PRINTING OFFICE: 1946

Gifts of the Americas

Manioc

by DOUGLAS M. CRAWFORD

Manioc, a tuberous root known also as cassava and mandioca, is a ranking foodstuff of millions of people in the tropical countries round the world. As manioc root, it is virtually unknown to the inhabitants of temperate zones. In processed state, however, the story is a different one. Among the housewives in the United States tapioca, one of the processed products, is well known in desserts, and, industrially, tapioca flour has many established uses. Other of manioc's finished products—dried slices, meal, flour, and compressed residue—are better known in Europe. Dried slices are utilized to manufacture various kinds of starches; manioc flour is used to make biscuits and crackers which are easily digested. Cassava grown in Southern United States has been used as a cattle feed. Modern Brazilian distilleries make alcohol from manioc.

In Latin America native uses of manioc are several. From the meal made by grinding the roots a flat type of bread is prepared by baking on top of an earthenware griddle. Sweet manioc is boiled and served as a vegetable, like potato. The flour is utilized in concocting thick native drinks. Intoxicating beverages are made from the juice of the sweet manioc.

Because Brazil has the greatest concentration of wild and cultivated species, that country is generally conceded to be the original habitat of manioc. There it is called mandioca. Cultivation of certain varieties dates from prehistoric times. In fact, many varieties are no longer found growing in wild state. On their arrival in the New World the Spaniards found edible varieties under cultivation on the Caribbean Islands and on the mainland from Mexico to Uruguay on the eastern seaboard and to Peru on the western.

At a very early date, probably by the middle of the sixteenth century, manioc had already been planted beyond the shores of the Americas. It was carried to other lands mostly by Portuguese traders rather than by Spaniards. Its first destination was the west coast of Africa, where it arrived as a result of the slave trade developed between that continent and Brazil. On the longer voyages to India manioc was sometimes taken aboard for use as a foodstuff, and this is thought to account for its introduction into parts of Asia. During the seventeenth century it was planted in South China, Malaya, and the East Indies. In the following century cultivation of this crop was begun in other tropical lands.

Although manioc is widespread in cultivation, only relatively few countries export its finished products. Before the war the Netherlands East Indies was the leading shipper by a sizable margin, followed by British Malaya and Indochina. Present day exporters include Madagascar, Brazil, and the Dominican Republic. The United States is the leading consumer of manioc starch; in Europe, Great Britain is the largest importer.

Of all the 130 odd species of manioc (*Manihot* spp.), the plant *M. esculenta*, or manioc, is most commonly cultivated. Manioc is a somewhat shrubby plant ranging in height from 3 to 18 feet. Botanically it is in the same family group as the castor-bean, Hevea rubber, and the poinsettia. In appearance it somewhat resembles the castor-bean plant. Manioc can be successfully cultivated over a wide latitude of growing conditions ranging from sea level up to elevations of about 7,000 feet. The crop produces in areas having less than 20 inches of rainfall as well as in tropical areas which have a yearly average of more than 100 inches, but its cultivation is restricted to areas having a mean average temperature of about 76° F.

Manioc roots contain a glucoside which is toxic, at times deadly, when the roots are eaten raw. The bitter, or commercial varieties, have a greater amount of the glucoside than the sweet, or food, varieties. This glucoside is rather closely akin to prussic or hydrocyanic acid. The toxic material is removed by heating the root and pressing out the juice. When processed, the juice of the bitter variety is called cassareep, which is a condiment and base for various meat sauces. A well-known West Indian dish called pepper pot is prepared with cassareep as a basis. In the producing areas cassareep is a meat preservative.

With Far Eastern regions not at present exporting, the Americas are being called upon to furnish supplies of industrial and edible starches from manioc. This situation, however, is likely to be a temporary one. Once the commercial manioc areas in other lands rehabilitate their processing industries, Western Hemisphere producers may have a difficult time competing in international trade. But manioc will continue as an important foodstuff in the tropical American dietary scheme.

RIVERS OF PUERTO RICO

{Continued from page 37}

today this area of only 3,435 square miles is one of the most densely settled spots in the world.

Agricultural production along the streams provides at least one-half of the income of the island. Almost two-thirds of the food consumed, in terms of weight, is grown on the island, including practically all of the starchy vegetables, fruits, and most of the meat and eggs. It does import all of its wheat flour, codfish, and fats and oils, almost all of its rice, and a few dairy products. In fact, it is an important market for the United States mainland. In return the island produces for export large quantities of sugar and lesser amounts of tobacco, fruit, and coconuts.

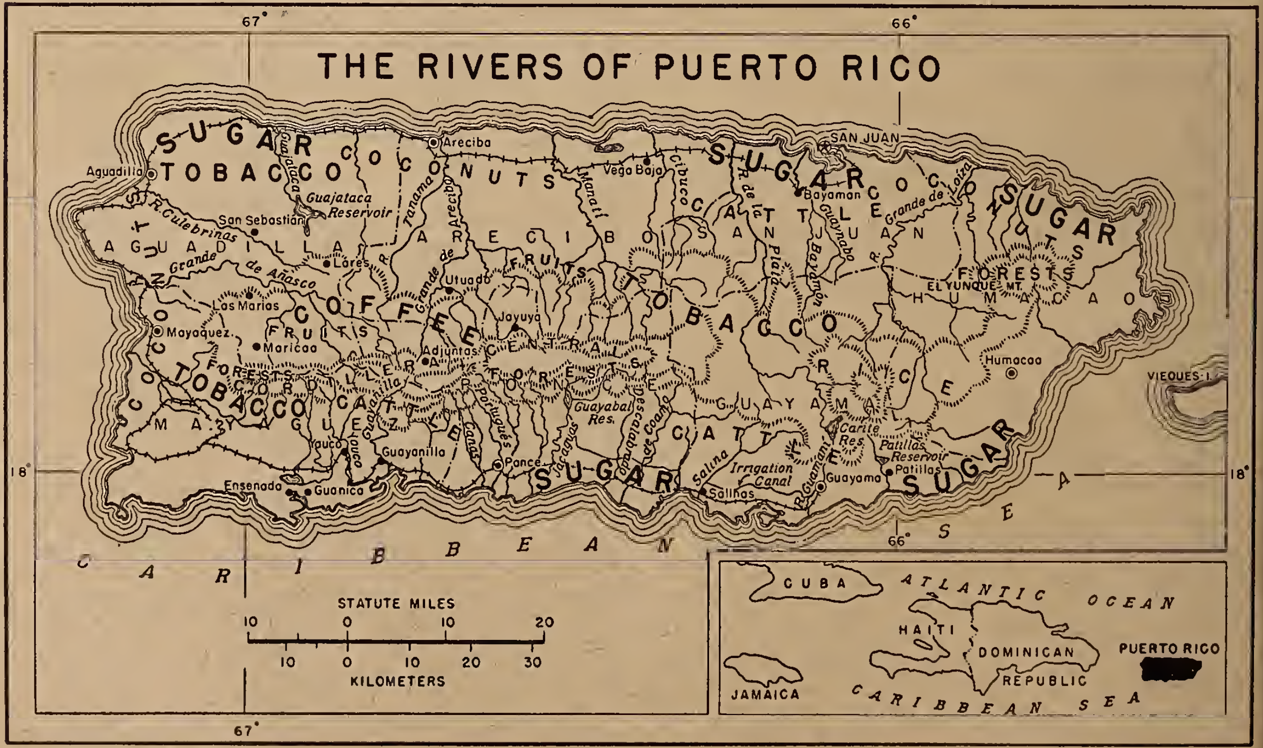
By far the most important commercial crop is sugar. Production during the past several years has averaged in the neighborhood of 1,000,000 short tons, the major share of which is exported. Ever since the first sugar was planted in 1515, this crop has played a big part in Puerto Rican agriculture. Today sugar occupies about 10 percent of the total land area. Ponce Province is the largest producer, although sugar is grown generally throughout the coastal regions.

Tobacco ranks second in value of exports. Production is concentrated largely in the valleys of the east-central region and in the northwest corner of the island. The United States takes a large share of the leaf exports, which are used as cigar filler.

The coconut is another valuable product brought to Puerto Rico early in the sixteenth century. It is used extensively in domestic industry as well as exported. The two important producing zones are from Vega Baja to Guayama in the east and from Manati to Guayanilla on the west coast. Pineapples and citrus fruit are raised for export, but a variety of fruits and vegetables are grown for local consumption. Products of the livestock industry also are used on the island. Purebred dairy breeds and some Zebu stock have been imported to improve the strains. Hog production is not as important as cattle and sheep, and goat output is relatively insignificant.

High quality coffee is produced on the mountainsides of Lares, Utuado, Adjuntas, Yauco, Ciales, Maricao, Las Marías, Mayaguez, Ponce, Jayuya, and San Sebastián. Years ago coffee was a major export of the island but the product is now used almost exclusively for the domestic market. Unlike sugar, both coffee and tobacco are small-farmer enterprises.

Because of the heavy concentration of people in so small a space, agricultural production is necessarily intensive and most of the available land must be used. Steep mountain slopes, cities, parks, and other areas unproductive for agriculture make up from 10 to 20 percent of the total land area. The rivers flowing through wide fertile valleys north of the mountains and those cascading down the steep sides of the southern slope do their part in making agriculture the predominant industry of Puerto Rico.



U.S DEPARTMENT OF AGRICULTURE

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Agriculture in the Americas

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March 1947

NAMES & NEWS

Filipino Representatives Study Agricultural Problems

Dr. Cornelio Crucillo and *Dr. Nicolas Sevilla,* of the Philippine Department of Agriculture, and *Dr. León González,* of the University of the Philippines, who had been in the United States since last August on grants by the United States Department of State, returned to the Philippines late in December via Hawaii, where they visited the Agricultural Experiment Station at Honolulu. Before leaving the United States the Filipino representatives attended a meeting of the members of the United States Agricultural Mission to the Philippines in Washington, at which time recommendations were made for the improvement of agriculture in the Philippines.

Lorenz Transferred To Washington

Rolland C. Lorenz, Head of the Department of Forestry at the Cooperative Agricultural Experiment Station, Tingo María, Peru, was recently transferred to Washington where he will serve as Field Service Consultant for the Office of Foreign Agricultural Relations. Mr. Lorenz's work at Tingo María has been mainly with the development of Hevea rubber, which has been strongly emphasized at the Peruvian station since the memorandum of understanding was approved by that country and the United States in 1942. Plant reproduction has been so successful that the future of the program as a whole looks promising.

Harold J. Brooks Returns to Peru

Harold J. Brooks, Head of the Animal Husbandry Department of the Cooperative Agricultural Experiment Station, Tingo María, will return in March to Peru after spending several months in the United States on leave and official business. During his visit here Dr. Brooks visited the International Livestock Show in Chicago; the Southeastern Brahman Breeders Show and Sale at Ocala, Fla.; Cornell University; and the Florida Experiment Station, where a number of experiments are being carried on in breeding, feeding, and parasite control for tropical and subtropical countries. On his way back to Peru Dr. Brooks plans to stop in Jamaica, Colombia, and Ecuador to study different animal breeds being developed in those countries.

Victor R. Berliner Returns From Colombia

Victor R. Berliner, Animal Physiologist, OFAR, has returned from Colombia, where he gave a series of demonstrations in artificial insemination of livestock before veterinarians and members of the faculty of the School of Veterinary Sciences of the National University at Bogotá. Colombian stockmen are much interested in the possibilities of artificial insemination because of the limited number of purebred sires in their country.

Wellman Returns From El Salvador

Frederick L. Wellman, who has been serving as Senior Pathologist and Assistant Director of the *Centro Nacional de Agronomía* of El Salvador, returned to the United States in December to complete a number of research projects and the writing of several reports. Dr. Wellman is on annual leave and will remain in this country for an indefinite period of time.

Charles F. Swingle Visits United States

Charles F. Swingle, Head of the Department of Horticulture and Agronomy at the Cooperative Agricultural Experiment Station, Tingo María, Peru, recently spent several weeks in the United States. During his visit he attended meetings on agronomy and physiology at the annual sessions of the American Society for the Advancement of Science, in Boston.

Agriculture IN THE *Americas*

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The Shiringero— Upper Amazon Rubber Tapper

In isolated settlements on the foothills of the majestic Andes lives the shiringero. He is a son of late nineteenth and early twentieth century rubber tappers, marooned there at the end of the rubber boom. Today the shiringero is again collecting latex from wild rubber trees.

by R. J. SEIBERT

Nearly 3,000 miles from the mouth of the Amazon, far from steamboats, railroads, and highways and even farther from the Pacific Coast when one considers the hardships encountered in crossing the Andes, lies the Department of Madre de Dios, Peru. Here, at the beginning of the recent rubber crisis brought on by World War II, were found living in isolated regions near the headwaters of the Acre and Madre de Dios rivers a comparatively small number of rubber tappers, called *shiringeros.**

They are descendants of the early *shiringeros*, who came to that area during the latter part of the nineteenth or early part of the twentieth century at the time of the first rubber crisis. Demands for rubber were increasing rapidly, and supplies were diminishing. Before the rubber plantations of the Far East came into production to alleviate the shortages, these men of many nations, known in Peru as *shiringeros* because they tapped the wild rubber trees, struggled farther and farther into the reaches of the Upper Amazon tributaries to find more wild exploitable rubber trees. They had reached sight of the majestic Andes and struggled up the foothills to the point beyond which rubber trees do not grow, when suddenly in the early 1920's the demand for wild rubber ceased, and the explorers found themselves without supplies or means of livelihood.

The Years Between

A large proportion of these abandoned men slowly worked their way down the streams and rivers, meeting various fates in their search for settlements. Others heard of gold deposits on the eastern slopes of the Andes and pushed farther on in the hope of that means of livelihood.

Of those who remained on larger rivers the majority concentrated their efforts on finding mahogany and cedar trees which could be cut and floated down river to some distant sawmill. Those who found themselves far from major rivers started to grow food crops. This was a long and difficult task, for the distribution of cultivated food plants is not rapid when they must be spread successively from distant neighbor to neighbor. These *shiringeros* were not agriculturally minded, and they tried desperately to find products of the forest to sell or trade for a few necessities. Their best source of seasonal income was the harvesting of wild Brazil nuts, if they were in an area where this species happened to occur. There were various demands for the products of latex- and resin-producing trees, such as balata, copal, and the *leche caspi* which they had always chewed and which was demanded by the North American gum-chewing

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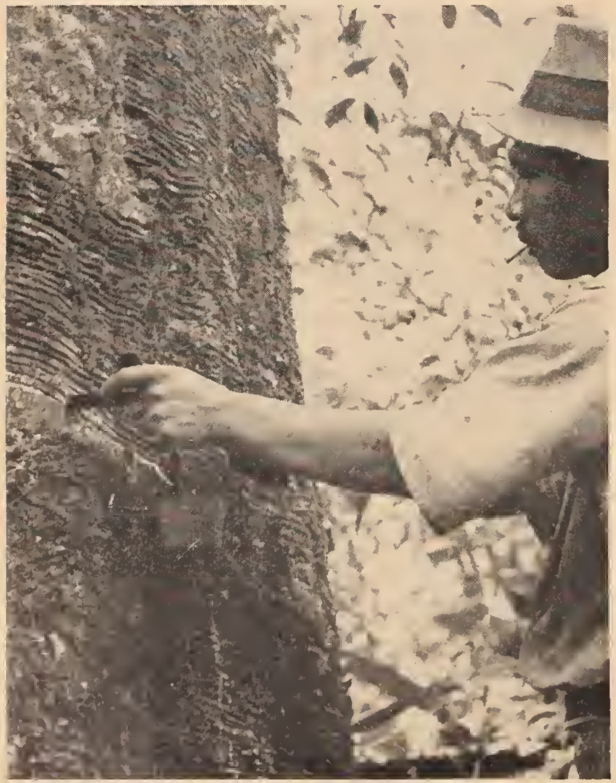
*In Peru the rubber tapper is a *shiringero.* In Brazil he is the *seringueiro.* In Colombia and Bolivia he is a *seringero* and sometimes *siringero.*

public. Some of their jungle medicinal plants were needed. Above all, they loved the jungle, because they liked to hunt. While searching for jungle cash crops they frequently killed wild pig, deer, and large cats, the skins of which they could dry and sell.

In a few areas of high-yielding trees of high-quality rubber, as are found where Brazil, Peru, and Bolivia meet, some of these men have continuously tapped the trees and sold some rubber ever since their fathers taught them the process. Living in the tropical forest and in small communities, they have had to turn to other forest products as a means of subsistence, but they have held an almost instinctive feeling and hope for the return of a market for their rubber.

The rubber tree furnished them with raw material from which they made shoes, tobacco pouches, waterproof cloth for raincoats and the bags in which they protected their few prized possessions from destructive tropical moisture. When supplies were still coming in, the *shiringeros* had become acquainted with the products of civilization. They knew the machete, firearms, manufactured cloth, needles, and thread. Yes, they even knew the modern sewing machine, and they liked such canned products as sardines and evaporated milk. Of special importance to their diet were sugar, coffee, and salt. They had never had to rely on growing their own food, for that and other necessities were brought in by traders who exchanged their wares for rubber. With little or no market for rubber they had to find other ways of obtaining their necessities.



Large *Hevea brasiliensis* tree which has been tapped more or less continuously for the past 30 years. Note the large number of cuts on the trunk.

The Shiringero Today

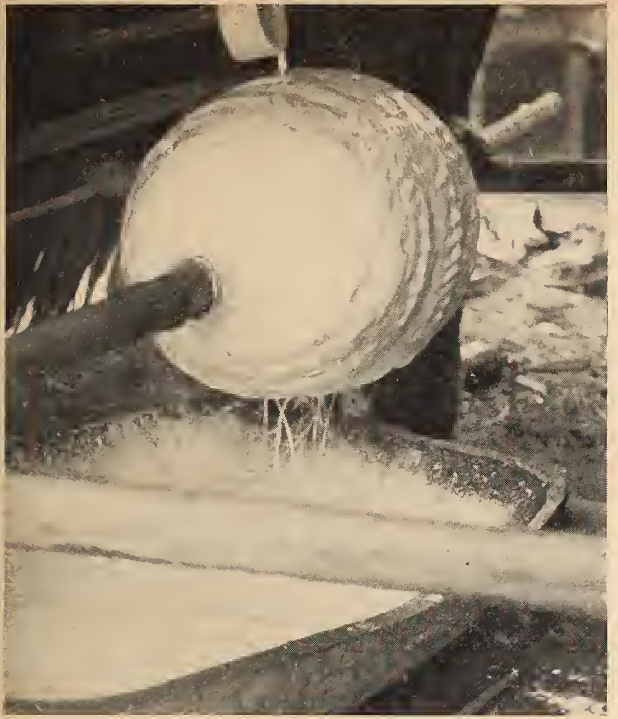
Those of us who in recent years have lived with and known the descendants of the early rubber tappers will never forget them and their contributions to the Allied effort. There were not many of these men in the vast area in which Hevea rubber grows wild, and they could scarcely make an impression on the hundreds of thousands of trees in the forests. But they have played an all-important role in accepting and teaching thousands of new men sent into the wild-rubber areas, who had never even seen rubber trees before and were not at all accustomed to this new and isolated life.

To secure the rubber latex, the *shiringero* starts at dawn, for he must walk perhaps 6 miles through his *estrada*, or trail through the jungle, along which there are a hundred or more rubber trees. Each tree must be tapped. This may take him until nearly noon, when he stops to eat and to drink coffee. His tasks are frequently diverted by the presence of wild game, which he must try to shoot if he is to have fresh meat for his family. During the afternoon he again walks along his *estrada*, collecting the latex from the tapped trees. By late afternoon he is back at his hut with his latex and immediately sets about its preparation, which usually means smoking it into large balls. This process takes several more hours, in a small thatched hut where he is exposed to strong wood or palm-nut smoke.

The *shiringero* has found that unless he has a wife and family to help him, or unless he neglects his daily tapping task, he has no time to grow his own food. Thus again supplies must be brought in from the outside. He is seldom unhappy. He is no longer subjected to bodily punishment if he fails to bring in his quota of rubber, as frequently happened during the earlier rubber boom. He has taken up soccer, which he plays with his neighbors on Sunday in some clearing in the jungle. The ball is frequently a home-

---

Mr. Seibert is a botanist with the Division of Rubber Plant Investigations, Bureau of Plant Industry, Soils, and Agricultural Engineering, USDA. During the past 3 years he has been in charge of a jungle Hevea selection program for the Division in Peru. At present he is on leave of absence at the Missouri Botanical Garden.

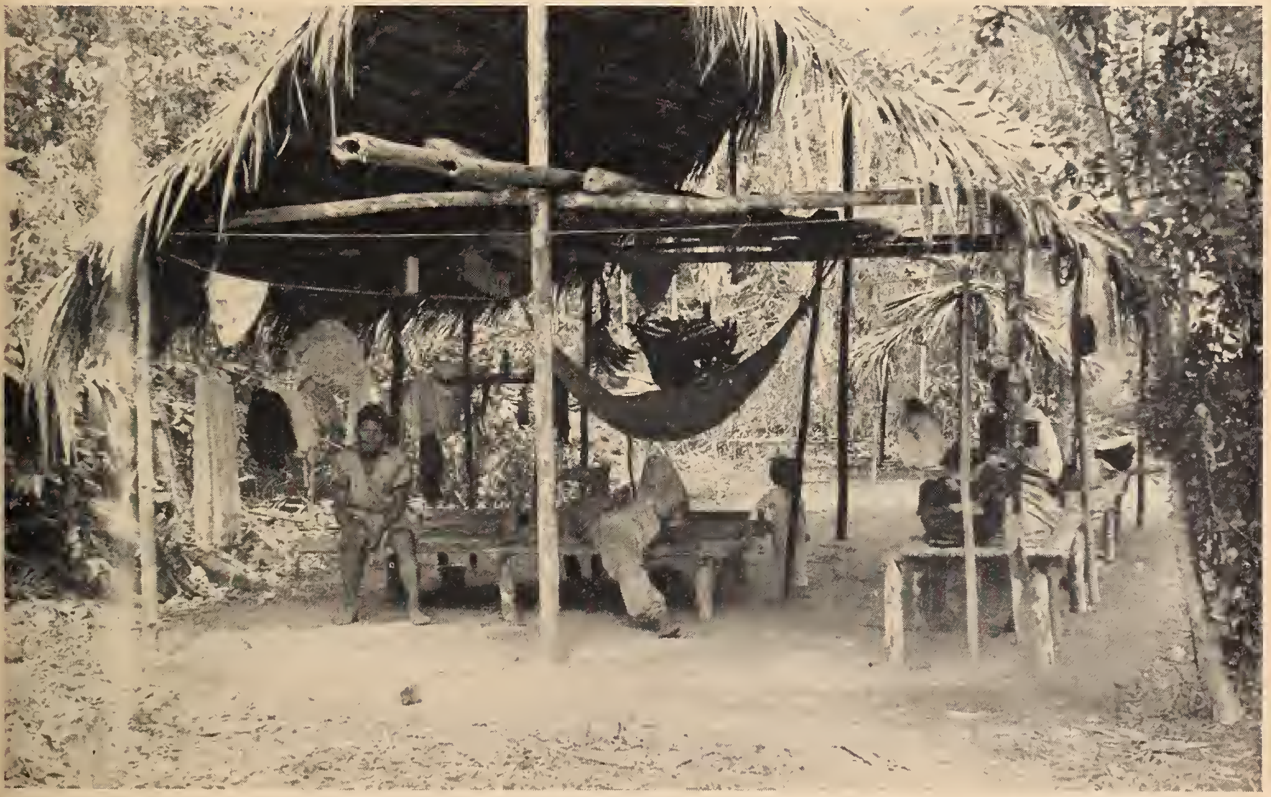


The rubber latex is smoked over a smudge of wood or palm nuts. Layer upon layer of latex is added to the ball until it reaches a weight of from 100 to 150 pounds.

made affair that he has made from the rubber latex. Births, deaths, and national and religious holidays are the centers around which his social life rotates. He is interested in having his children go to school and sends them to the closest school maintained by his Government or Church, though that may be a long way off.

With the influx of the new tappers the *shiringero* has again come into contact with the outside world, which in the meantime has become still more mechanized. He again uses kerosene, but now it makes a much brighter light than it did when he was a boy. Not only that, he sees a machine which burns kerosene in a lamp down below and makes ice on top. Though he may not have come in contact with an automobile, he has seen and touched the airplane which brings his supplies and takes away his rubber. He has always known something of rapid communication through his "grapevine" system of spreading news, but he finds the radio far superior.

The life of the *shiringero* is still an unusual and not an easy one. If he could continue to sell enough of his jungle products, however, he would certainly like to buy many of the new things he has seen and about which he has heard.



The rubber tapper, his family, and possessions are frequently protected by little more than a thatched shelter.

Forest Resources Of Western Ecuador

Balsa wood for life rafts and airplane construction, cinchona bark for quinine, and many other products come from Ecuador's woodlands. These served important purposes in World War II, and their continued use under a peacetime economy offers commercial possibilities.

by EUGENE F. HORN

During the war the forests of Ecuador proved to be the country's greatest commercial asset. Besides yielding woods possessing a wide range in physical and mechanical properties and, therefore, of widely diversified usefulness, the forests of Ecuador produce rubber, cinchona bark, vegetable-ivory nuts, kapok, tannin, dyes, vanilla beans, resins, gums, waxes, barbasco, palm oil, bamboo,* and the toquilla straw used for weaving Panama hats.

Because of the great wartime demand for balsa lumber, which was widely used in the construction of life rafts and planes, exports of balsa increased to over 30,000,000 board feet during 1943. In fact, during the last 5 months of 1943 balsa lumber was exported at the rate of 48,000,000 board feet annually. Exports of cinchona bark, which were small before the war, also increased enormously. Between December 1, 1941,

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*See "Bamboo in Ecuador's Lowlands" in the October 1945 issue of *Agriculture in the Americas* and "Bamboo in Ecuador's Highlands" in the October 1946 issue, both by F. A. McClure.

and August 1, 1945, Ecuador exported 4,868,000 kilos of cinchona bark to the United States. Rubber is another forest product whose production was greatly stimulated by wartime demand.

Physiographically, Ecuador can be divided into three regions: The Andean highlands, the Amazon region east of the Andes called the *Oriente*, and the coastal region between the Andes and the Pacific Ocean, called the *Litoral*. With the exception of the eastern and western foothills and mountain slopes, the Andean highlands are treeless. Both the *Oriente* and the western coastal region are heavily forested with the exception of a narrow area near the coast, where the rainfall is not sufficient to support forest growth. Since eastern Ecuador is largely inaccessible except by pack train, the forests have not been exploited to any extent, except for cinchona bark and, to a lesser extent, rubber. Many navigable rivers traverse the coastal forest region in western Ecuador, and that region supplies the bulk of forest products produced in the country.

Woods Suitable For Many Uses

A survey made in 1943 by the U. S. Forest Service in cooperation with the Office of the Coordinator of Inter-American Affairs showed the coastal forest to be extremely varied in composition and to contain woods suitable for many commercial and industrial purposes. Woods ranging in weight from 5 pounds per cubic foot for balsa (*Ochroma lagopus*) to 80 pounds per cubic foot for cascol (*Libidibia corymbosa*) are found in these forests. Cascol is proving suitable for making the frames and wheels of pulleys because of its hardness, interlocking fibers, and great strength. Some kinds, such as guayacán (*Tabebuia chrysantha*), madera negra (*Tabebuia* sp.), pechiche (*Vitex gigantea*), guachapelí (*Pseudosamanea guachapele*), coquito colorado (*Erythroxylon glaucum*), and moral fino (*Chlorophora tinctoria*) are extremely durable when exposed to the weather and are valued for such uses as for poles, foundation timbers in buildings, and railway cross ties. Moral fino is the fustic wood of the dyewood trade, but none is exported from Ecuador for this purpose. Gauchapelí is widely used in ship building, pechiche for tight cooperage, and the purplish-brown heartwood of coquito colorado appears suitable for knife handles, hand-saw handles, billiard-cue butts, brush backs, and similar articles.

Other woods, such as cedro or Spanish-cedar (*Cedrela* spp.) and figueroa (*Carapa guianensis*), are not susceptible to the attacks of termites and other wood-destroying insects and are, therefore, widely used for furniture and construction purposes where these insects abound. Figueroa is called tangaré in the Province of Esmeraldas, crabwood in British Guiana and Trinidad, and andiroba in Brazil. The seeds are the source of an oil used industrially in Brazil for making soap.

A few Ecuadoran woods, such as bálsamo (*Myroxylon balsamum*), laurel de cerro (*Cordia* sp.), laurel negro (*Cordia alliodora*), and amarillo de Guayaquil (*Centrolobium* sp.), are highly figured and possess undulating grain. They are capable of receiving a brilliant polish, making them highly suitable for cabinet work, interior trim, fixtures, and similar purposes. The bálsamo fixtures, interior trim, and furniture of the Hotel Metropolitano in Guayaquil have caused much favorable comment because bálsamo resembles Cuban mahogany in a finished condition. This tree yields a vanilla-scented resin known in El Salvador as *bálsamo de Peru.** It also

These roots of mangrove trees will be covered with water at high tide. The trees rise to a height of 130 feet.

**See* "Balsam of Peru From El Salvador," by Frederick L. Wellman, in the May 1945 issue of *Agriculture in the Americas*.

Some of the larger balsa rafts contain from 20,000 to 25,000 board feet of lumber.

yields an oleo-resin called *tolu balsam* or *balsamum tolutanum* in Colombia. Neither of these products is exploited in Ecuador. Much of the better office furniture in Guayaquil is made of laurel de cerro. In a finished state it is not unlike Circassian walnut. Laurel negro or laurel de montana is somewhat darker in color and resembles North American black walnut after finishing.

Problems in Utilizing Ecuador's Forest Resources

Although the forests of western Ecuador contain hardwoods of rare value, they also have many species which are not merchantable. For example, of 40 arborescent species encountered on a large estate in the Province of Los Rios only 12 are of commercial value at present, and of these 6 are suitable only for boxes, crates, concrete forms, and temporary construction purposes. The removal of the merchantable species presents serious logging problems. Indeed, it frequently costs more to remove the few scattered trees than they are worth. Lumber manufacturing costs are also increased by the difficulty of sawing and handling so many different kinds of timber, and so are the costs of seasoning, classifying, storing, and distributing the finished lumber.

Contrary to popular belief, the majority of trees found in humid tropical forests produce soft, lightweight, perishable woods. These softer woods are not utilized to any extent at present, and the exploitation of Ecuador's forests will probably not be financially successful until some commercial use can be found for them. If all species on a given area were merchantable, many of the obstacles to the development of these forests would be eliminated. Perhaps the solution of this problem lies in a combination of sawmills, veneer mills, pulp mills, and wood-distillation plants, which will utilize all species of trees growing on a given tract of land.

Mangrove Forests

The mangrove forests in the Province of Esmeraldas offer interesting possibilities for development on a large scale. Mangle colorado (*Rhizophora mangle*) occurs on the tidal marshes along the coast and the estuaries of rivers in association with mangle blanco (*Laguncularia racemosa*), mangle jelí (*Conocarpus erectus*), and mangle negro (*Avicennia nitida*). This is a region of optimum development for the red mangrove, and it frequently occurs in almost pure stands with a high volume per acre.

The bark of the red mangrove contains 20 to 30 percent tannin, and the reddish-colored wood is hard, heavy, strong, tough, and durable. Only in Ecuador, among the South American countries, is the wood used for general construction to any extent. Because of its durability under tropical climatic conditions it is widely used for corner and floor posts, rafters, beams, and joists in buildings, and for cross ties, piling, charcoal, and firewood. Tests made by the Pulp and Paper Section of the Forest Products Laboratory at Madison, Wis., revealed that red mangrove pulps well by the soda process. It gives an exceptionally large yield of cellulose on the volume basis as a result of its high density.

The logging of mangrove swamps is somewhat similar to the logging of cypress and swamp hardwoods in southern United States. Use of an overhead cable method is necessary because of the great mass of tangled roots on the ground. Donkey engines for skidding out the logs could be mounted on scows of shallow draft which could be floated to the edge of the mangrove swamps at high tide. The logs could be peeled mechanically at the mill and the bark sold to tanneries, or tanning extract could be manufactured at the mill.

Outlook For Balsa And Other Forest Products

Although the peacetime demand for some Ecuadoran forest products will probably be only a small fraction of the expanded wartime production, certain forest products will no doubt continue to be exported.

Mr. Horn, who is a forester by profession, has spent many years in Brazil where he has been engaged in forestry, logging, and the management of tropical estates. Recently he was a member of a U. S. Forest Service Mission which made a survey of the forest resources of Western Ecuador.

For example, balsa lumber is expected to be more in demand than before the war. It will continue to be used in airplane and life-raft construction, especially in smaller planes and gliders. Before the war several million feet of balsa lumber was used annually in making model airplanes, and for this purpose the postwar demand is likely to be in excess of prewar requirements.

Perhaps the brightest future for balsa lumber is in the box industry. Before the war airplane shipments of yeast were regularly made in balsa boxes. The development of the cargo airplane has created a demand for a new type of container for the shipment of commodities by air. The heavy, costly crates or boxes in which merchandise is packed for shipment by rail or water are not generally satisfactory for air shipments. The lightness of balsa, combined with its comparatively good strength and excellent insulating properties, recommends it as a first-class material for the fabrication of containers for air shipment of some commodities. Balsa lumber should also find a place in the refrigeration industry as a competitor of cork for insulating purposes.

The outlook for the exportation of hardwood logs and lumber is not so promising as that for balsa. Some of the finer cabinet woods will no doubt find a market in the United States along with certain woods whose mechanical and physical properties recommend them for special uses. The trees with soft, lightweight, perishable wood, which make up the bulk of the forest, yield lumber which is suitable only for short-term use as in containers. Already there is a fairly large domestic demand for boxes for petroleum products, beer and soft drinks, matches, food products, and general merchandise, and expansion of existing industries as well as establishment of new industries will increase these and similar demands.

New forest products are constantly being discovered. Two laticiferous trees of western Ecuador are reported to yield a gum similar to chicle, which has commercial possibilities. The common herbaceous plant, bijao or hojas blancas (*Calathea insignis*), should be investigated as a possible source of wax. A thorough scientific examination of the enormous flora of western Ecuador might reveal many new products which would find application in modern industry.

Natural stand of balsa wood trees near Piedras, Province of El Oro.

Nutmegs From Grenada

On a tiny island, 21 miles long and 12 miles wide, grows a substantial portion of the world's supply of nutmeg. Grenada, one of the British West Indies, is in the Caribbean Sea, approximately 100 miles north of Venezuela.

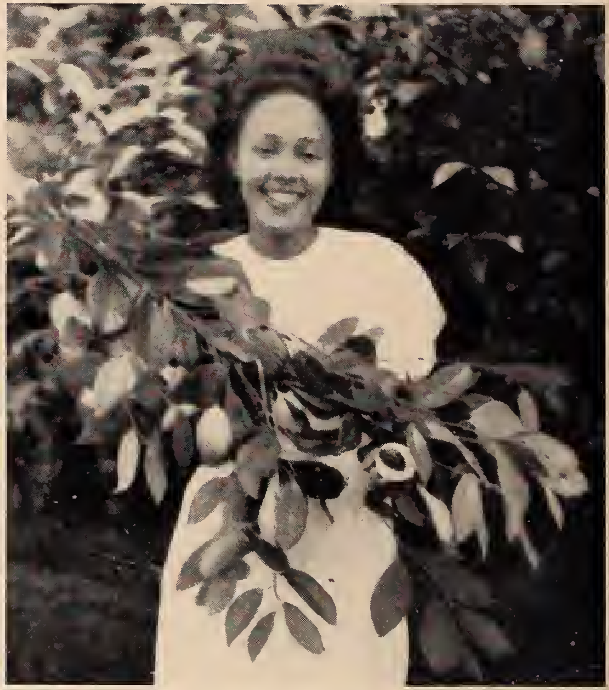
by CHARLES H. WHITAKER

Old residents say that some time around 1843 a certain Grenada planter entertained sumptuously the captain of a visiting Dutch ship and, in the course of numerous rounds of strong Grenada rum, induced him to leave a few seeds of the nutmeg tree which he was taking to Holland from the Dutch East Indian island of Banda. The nutmeg trees did very well in the damp yet sunny, breezy, and equable climate of Grenada, and by 1865 Grenada nutmegs began to reach the world markets in noticeable quantities. By 1939, production had increased so much that about a sixth of the world supply came from the little island, and the industry has been steadily increasing up to the present time.

Ideal Conditions For Nutmeg Production

With proper soil and climatic conditions the growing of nutmegs is relatively simple and involves merely cutting underbrush below the trees from time to time and gathering the nuts as they fall. The tree seems to grow best quite near the sea, on islands, between 500 and 1,500 feet above sea level. More or less constant rainfall throughout the year is necessary. A large part of the fertile mountain slopes of Grenada above 800 feet elevation are covered with thick groves of nutmeg trees.

The trees grow so close together on the steep hillsides that they make a dense unbroken canopy over the ground. Because of the sharp slope of the hillsides, mechanical cultivation is out of the question. Trees are planted, therefore, not in rows, but here and there wherever there seems to be room enough to grow. Sunlight never reaches the ground under the thick foliage canopy in the older groves. Instead, a carpet of tender bright green moss and ferns often covers the ground.



Typical spray of nutmeg foliage and fruit. On the young lady's right is an unopened pod; directly in front of her is a pod just beginning to open; and on her left is an opened pod showing the shiny, walnut-brown nut with its lace-like coat of bright crimson in yellowish plum-like fruit.

While the average annual rainfall in areas where nutmegs grow in Grenada is about 80 inches, in some of the groves it reaches over 200 inches a year, and plantation owners take special care to provide good surface drainage by cutting canals to let off the water. An old well-cared-for plantation often looks like a checker board, with trenches 3 feet deep bordering the squares, in the middle of each of which is a nutmeg tree. But even with the heavy rains, the streams

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run crystal clear, since the nutmeg roots, delicate ferns, and grasses cover the ground so completely.

The nutmeg tree, *Myristica fragrans*, is a fairly erect, clean-growing tree, a little wider than a fir. In Grenada it grows about 25 feet high, though in the Netherlands East Indies it grows to about 70 feet. The laurel-like leaves, alternate lanceolate and acuminate, are not much darker in color than a fresh head of lettuce, though they grow darker as the leaves grow older. At times the tree harbors a type of fungus growth (sooty mold) and becomes almost black, but the new bright green leaves of the fresh growth, always present in the mountain groves, give the landscape a richly fertile and fresh bright appearance.

Both male and female trees blossom—bell-shaped, yellowish-green flowers that hang down on short green pedicels, those of the female tree being smaller and about the shape and size of a blueberry blossom. In Grenada the male trees bear no nutmegs but must be present in sufficient numbers in any plantation to fertilize the female trees. In the Far East, however, the male trees are not absolutely unproductive.

Nutmeg tree between 30 and 40 years of age showing the dense leafage and definite pyramidal shape. This tree had about 5,000 nutmegs in various stages of maturity at the time this picture was made.

No attempt is being made to breed a special heavy-yielding strain. Seedlings about 6 feet high are dug up from wherever they happen to grow. After about 3 to 5 years the tree declares, that is, makes known whether it is a male or a female tree, and the proportion of the two can then be adjusted in the plantation.

Trees must be pruned and suckers cut out from time to time. The ground underneath must be kept reasonably clear of weeds by means of a cutlass or machete so that the fallen nuts can be easily found. Some estates, though not many, add manures or lime to the soil. Grafting is not carried on in Grenada.

After about 6 or 7 years the tree begins to bear inconspicuous, small, greenish-yellow, globular flowers, which soon change to a little fruit the shape of a very small plum. This grows, in 9 to 11 months, into a smooth, bright yellow, plum-like fruit which, upon ripening, splits across the bottom revealing a shiny dark brown nut with a bright crimson lace-like netting about it. This reddish covering is the mace. In a few days the yellow fruit opens wide enough to let the nutmeg fall to the ground, where its bright red covering makes a vivid contrast with the reddish clay soil or brownish leaf mold. Thus it is easily found by the women who go through the plantation every few days to gather the nuts which have fallen. In the Far East nutmegs are picked from the tree before the husks split, but in Grenada the husk is allowed to split and the fruit is picked up from the ground. If it is not gathered quickly, it gets water-logged and ferments or starts to grow and weevils and worms easily enter the shell.

Diseases and Pests

The nutmeg planters in Grenada have not, so far, been bothered by any serious pests. The most dangerous insect, *Phloeosinus cribratus* (Blandford), which was probably responsible for the devastation of the Singapore nutmeg plantations in 1860, has not made its appearance on the Island. This is a small beetle which attacks the cambium layer of the tree sometimes above and sometimes below the ground. Often the first indication of the presence of this insect is the sudden death of the tree from no apparent cause. These beetles breed rapidly and can become epidemic in the speed with which they spread. The only remedy known to date is to dig up the tree and burn it.

The three principal diseases of nutmeg—Rosellinia, Stem canker, and Phyllosticta—are not at present serious in Grenada. *R. bunodes* is a dangerous fungus which attacks the root of the plant in moist places.

It is evidenced when the leaves of one side of an otherwise healthy tree fade and eventually wilt and die. Examination of the bark of the roots on this side of the tree will reveal a bright blue color, which is believed locally to be an undeniable evidence of Rosellinia. The only remedy seems to be to cut out the infected parts and treat the wounds with tar to disinfect them.

Stem canker is evidenced by exudations of gum from the bark of the tree. The name of the fungus which causes this ailment has not been determined locally. It is believed to be spread by insects from one tree to another. When affected, the tree soon dries up. *Phyllosticta* attacks the foliage and causes round holes, which grow larger and seriously impair the function of the leaves. This is also more prevalent in higher damper areas.

Mistletoe is a parasite which sometimes gets hold and does considerable damage. A wound parasite, *Eutypa erumpens*, caused some damage to the nutmegs in Grenada about 30 years ago but of late has given little trouble.

Production

A nutmeg tree begins to bear at 6 or 7 years, reaches full bearing at 20 to 25 years, and continues to bear for 100 years or more, although after about 60 years the yield decreases. A tree in full bearing yields approximately 1,000 nuts, or 50 pounds of green nutmegs, a year. In general practice an acre contains perhaps 90 or 100 trees, many of them too young or too old for full bearing. The yield per acre is, therefore, assessed at 1,500 pounds of green nutmegs a year which, when dried and cracked, average about 720 pounds of sound nuts.

Nutmegs are usually dried in the sun for a few days when they first come in from the field. During the drying they are moved every few hours by an attendant with a wooden rake.

The nutmegs are brought in from the field in large canvas bags strapped to the backs of donkeys or small horses. As the nutmegs arrive from the pickers they are heavy and wet and will not be ready for shipment for 6 months.

Estimates indicate that about 10,000 acres of the Island are devoted to the cultivation of nutmegs, of which some 70 percent are in plantations in the hands of large holders and the rest in small plots of from 1 to 5 acres in the hands of peasant proprietors. It is also estimated that there are about 14,000 peasant proprietors in Grenada out of a total population of 72,055 and that probably about half of the total population of the Island is engaged in nutmeg cultivation.

The cost of producing sound cracked nutmegs was assessed in 1944 as slightly over $0.08 a pound. This includes overhead costs, gathering, cracking, sorting, bagging, and transporting the nuts from the country to St. George's, the shipping point for the Island.

Harvesting, Drying, And Curing Nutmegs

Nutmeg trees produce all the year round, but the major crop is harvested from September to February. Gathering of nutmegs is done every few days by native women who often pick up the nuts with a simple ingenious device which saves them from bending down for each nut. They spear half of a hollowed-out nutmeg pod with the point of their cutlass and use this as a little spoon to pick up the nutmegs as they go along. They put the nutmegs in large round baskets in which they carry them, on their heads or by donkeys, to the *boucan* or storing and drying house. Usually a woman "driver," or sub-foreman, works with four or five others as a gang, which has a definite area to cover each day of the week. They usually do their task between 8 o'clock in the morning and 1 in the afternoon.

As soon as the nutmegs reach the *boucan*, the mace covering is removed and dried separately. It later goes into export as a fragrant and highly aromatic spice.

The remaining nuts are dried in shallow trays under cover. Some of the drying frames are 20 by 10 feet, and some of the *boucans* are as much as 80 by 30 feet. It is important that the nuts should be spread not deeper than 3 inches in the trays in order to prevent fermenting and to insure proper curing. Three times a day a workman stirs the drying nutmegs with a long-handled wooden hoe to make sure that they are properly ventilated. Some planters cover their nutmegs with a thin coating of powdered lime to guard against the attack of insects and fungus. Nutmegs can be easily injured during the curing process.

After a few weeks of curing, the dried nuts are shovelled with large hand-carved wooden shovels into bags and stored in a well-ventilated place until just before the time for shipment arrives. In this stage the nutmeg which the American housewife knows is covered by a shiny dark brown shell approximately a quarter of an inch longer and wider than the nut itself, in which it rattles when shaken.

Just before time for shipping, the bags are taken out, one bag at a time, and the nutmegs dumped in large piles upon a clean wooden floor. Women with small wooden hammers rapidly crack the shells. The noise of cracking nutmegs is a characteristic one in Grenada. As a person walks along the street outside a large export house, he hears what sounds like hundreds of hammers pounding furiously.

Nutmegs are gathered during the morning hours and are picked up either by hand or by means of a specially made "spoon" which this woman carries in her left hand.

Nutmegs Go to Market

The cracked nuts are carefully picked over to remove those which are not sound. Sometimes the nuts are placed in a large cauldron of water. The defectives, which are generally made up of wormy or corky nuts, float and are skimmed off. These are dried and shipped as "grinders" for use in the distillation of nutmeg oil. The sound ones are dried and shipped for use as food. Large exporters lime some of their nutmegs before shipping, by dipping a basket one-third full of nutmegs into a half tub of water in which slaked lime has been mixed. The nuts are shaken around until they are fairly coated with the lime mixture and are then dried in the air.

In Grenada, nutmegs destined for England are graded into the sizes 60's, 65's, 80's, 110's, and 130's, referring to the number of nuts to the pound. For the United States market they are divided into only two classes—sound nutmegs, which are used for food purposes or distilling, and defectives, which are used only in the distillation of nutmeg oil. In the Netherlands East Indies the appearance of the nut is considered important, and the sound ripe nuts are separated from the so-called wrinkled ones which, because of disease, wind, premature picking, or other external causes, have not developed normally.

Nutmegs are shipped from St. George's, the only shipping point on the Island, in burlap bags, each containing 200 pounds. A certificate of inspection by local government agricultural agents is required. The nuts go to New York, London, South America, Australia, and Canada.

Bags of nuts are loaded direct from warehouses on the waterfront into large flat- or round-bottom lighters carrying 10 to 35 tons. These are propelled across the harbor to the pier by lightermen with sculling oars. During the war, ships rarely called at Grenada, and nutmegs were transported in sailing schooners to Trinidad for shipment by steamers calling there.

All nutmegs imported into the United States are carefully inspected by the Pure Food and Drug Administration. During the last few years, this country has taken five-sevenths of the Grenada crop.

Goats Test Feed Value of Coffee Pulp

Frequently animals make newspaper headlines through their service in scientific experiments. In El Salvador goats and cows are proving useful in feeding tests which may be valuable to El Salvadoran farmers in establishing most efficient feeding practices.

by MARIO LEWY v. S.
and SAMUEL H. WORK

At the *Centro Nacional de Agronomia* in El Salvador a series of experiments are under way to determine by strict chemical analysis and digestibility trials the probable nutritive value of numerous unknown feedstuffs existent in El Salvador. For the digestibility trials of the different feedstuffs, five young goats, donated through the courtesy of Dr. Alfonso Quiñonez M., are being used as living test tubes. For the productive-value trials of the same feeds, cows and other animals will be used.

Goats, rather than sheep or larger animals, were selected for the digestibility experiments for practical reasons. Sheep in El Salvador are much more scarce than goats, and the price is therefore almost prohibitive. Since goats are small, they consume less feed, an important factor where the immediate supply is limited, and they can be handled in cages, with special apparatus, during the time of experimentation. All classes of farm animals are known to digest concentrates equally well, and since the roughages to be tested will be of good quality, goats should be well able to utilize them and so give reliable answers.

Coffee pulp for stock feed. Sack in back contains crude pulp as obtained when coffee is cleaned for market. Sack in front contains ground pulp.

Need for This Type of Work

In Latin America the productive abilities of animals are rapidly being improved by breeding. There has not been a corresponding increase in the knowledge of the nutritive value of available feedstuffs. The old-time criollo cows—and some of them still are present—had many admirable qualities, particularly those having to do with adaptability to existence in their own environment. Their descendants, however, graded up to varying degrees of purity in the blood of different dairy breeds, have produced more milk during lactation periods of equal length, and so have higher nutritional requirements. Also the young of these improved animals have higher growth requirements and are, as a result, not as compatible with their environment.

In temperate climates an abundance of well known feeds and forages is available for animal feeding, and rations can be compounded easily, but in the Tropics the reverse is true. The well known feeding materials are either lacking entirely or are present in insufficient amounts, and they are too costly to be used economically. There is, however, an abundance of many materials that are eaten by different classes of animals throughout the year. For the most part, the nutritive value of these feeds remains un-

The five goats that were used in the digestibility trials.

known, and intelligent feeding for productive purposes, using these feeds, cannot be done until such information is obtained.

Chemists and Goats Work Together

The chemistry department of the *Centro Nacional de Agronomía* has undertaken to determine by chemical examination the composition of the various feedstuffs, a knowledge of which is necessary for intelligent feeding practices. Not satisfied that values obtained in the laboratory alone are practical, the chemists have turned to experiments with living goats. Because the animal body is not able to utilize completely the ingested nutrients, the goats are asked, figuratively, "Do you like this particular feed?" and "How much of it do you actually use?"

During the experimental periods the animals are confined in cages, with special feeding mangers. The period of constant intake of the feed being tested extends over 15 days, the first 10 of which are preliminary. During the last 5 days, by means of adjustable apparatus, the fecal material is collected and carefully analyzed. This analysis compared with the analysis of the feed consumed tells the story of how much of the particular feed is digested.

Dried Coffee Pulp With Dried Banana Leaf

Wherever possible, single-feed trials are run, but on occasion it has been necessary to combine several feeds because the unknown was not highly palatable. This has been the case with dried coffee pulp, which was the first material studied. Tests made in California indicate that this material is not unpalatable, and other trials of coffee pulp in the form of silage and as dried pulp give evidence of its actual feeding value, but to our knowledge this is the first time the digestibility of the dried pulp has been determined, though similar trials using the material as ensilage have been made. For El Salvador, the dried pulp is more practical than silage as a feed, as most of the coffee fincas have patios where the pulp can be sun dried quickly, but few silos exist. An abundance of coffee pulp is produced each season, which, if it can be used as a feed, will be of great value to the Republic. The goats refused to eat the dried coffee pulp if it was fed alone, but when mixed with dried leaves of the banana plant (*Musa* spp.) in the proportion of two parts of pulp to one of dried banana leaf the mixture proved quite palatable.

(*Continued on page 58*)

Mario Lewy v. S. is Head of the Department of Chemistry, *Centro Nacional de Agronomía,* Santa Tecla, El Salvador. Samuel H. Work is Animal Husbandman for the USDA Office of Foreign Agricultural Relations.

ALONG THE *Agricultural Front*

▲Panama Steps Up Agricultural Development

Panama's National Assembly has recently authorized the National Government to negotiate an internal loan for the development of agricultural land in the interior of the Republic. Farms will be sold to farmers of limited income on easy payments over a period of 20 years, giving preference to those now occupying the lands. The fund will be used also to provide agricultural machinery and tools, carry on an educational program for training in scientific farming methods, and provide seeds at minimum prices.

A project for raising peanuts and sesame, backed by the Ministry of Agriculture and Commerce also, is being carried on in cooperation with an oil company. Seeds which the company imported from the United States and Ecuador have been distributed to farmers in the interior. The entire harvest from the first crops will be used for further planting, but subsequent crops will be used in the manufacture of cooking oils. Experiments have proved that both peanuts and sesame can be grown successfully, especially in the Province of Chiriquí. If sufficient farm labor joins the project, it may prove successful. At least 10,000 acres must be cultivated to make the enterprise worth while.

▲Canada Develops Rust-Resistant Oats

Canadian plant breeders and plant pathologists have developed a new variety of oats, resistant to all types of stem rust and crown rust which have appeared in Canada and, it is said, resistant also to loose and covered smut. This development is the result of 14 years of intensive work at the Dominion Rust Research Laboratory at Winnipeg. Although the new variety has not yet been named, about 1,500 bushels of it are expected to be available by the spring of 1947 for distribution to selected growers. They, in turn, will increase production of seed so that there will be enough for all farmers in Canada who may wish to plant it.

▲ Cuba Gives Subsidy For Tobacco

The Cuban Government has established a $4,000,000-a-year fund to purchase surplus leaf tobacco and subsidize various sectors of the Cuban tobacco industry. The purpose of the fund, which will be financed by a 1-cent increase in the price of cigarettes per package, is to assure a minimum price to growers and to alleviate unemployment among tobacco workers brought about through the use of cigar-making machinery and loss in volume in cigarette output because of the price increase. The use of this fund will be linked with a plan to avoid tobacco surpluses by planning production. Cuba's 1945–46 tobacco crop, which was estimated at about 71,000,000 pounds, was the largest in 15 years. Because of the size of the crop and some reduction in export demand, prices dropped to a level about 10 to 15 percent below that of 1945, when they were unusually high.

▲ Soil Erosion Menaces São Paulo Cotton Production

The Brazilian State of São Paulo, one of the world's most important cotton producing and exporting areas, is confronted with a serious soil-erosion and soil-depletion problem. At a recent meeting of São Paulo cotton producers at the State Secretariat of Agriculture it was pointed out that cotton production has dropped sharply in the last few years. One large São Paulo producer stated that not only have yields on virgin land fallen off considerably, but the size of cotton plants and quality of cotton fiber have decreased.

▲ Grasshoppers Destroy Crops in Southern Brazil

A sky-darkening mass of grasshoppers, covering an area 65 miles long and 40 miles wide, appeared in Southern Brazil several months ago. Despite all efforts by the Brazilian Department of Agriculture and the army to combat the horde, the grasshoppers caused great destruction of wheat, rye, and other crops.

▲ Argentina Producing Commercial Dried Apples

Argentina is now producing significant quantities of dried apples. A recent survey showed that, while Argentina produced only a minor amount of dried apples in 1939, production gradually increased during the war years. Production for 1946 ran about 200 tons as compared with 100 tons the year before.

▲ U. S. Department of State Announces Student Grants For Coming Year

The U. S. Department of State has announced a limited number of travel and maintenance grants to assist United States graduate students carrying on studies or research in other American republics.

The grants are awarded to qualified candidates to supplement personal funds or funds they may expect to receive through fellowships or other assistance from universities, and provide travel or maintenance, or both, in accordance with the individual needs of the student. Successful candidates are expected to remain in residence for the purpose of study or research for not less than 6 months and not more than 1 year.

Application blanks may be obtained from the American Republics Section, Division of International Educational Relations, U. S. Office of Education, Federal Security Agency, Washington 25, D. C. Deadline for return of applications is March 1, 1947.

THE RIVERS OF PANAMA

by MARY S. COINER

Several hundred rivers rise in the highlands of Panama and flow through fertile valleys and tablelands generally north to the Caribbean Sea or south or westward to the Pacific.

The only two river systems of much size in Panama, the Bayano and the Tuira, empty into the Pacific. The latter is the only river of commercial importance. For a distance of 100 miles it is used to transport to the seacoast the inland products of Darién.

Originating in the Cordillera de San Blas and flowing southwest, west, and then northwest toward the Caribbean, is the Chagres. Its waters are dammed at Gatún, forming a lake which supplies the water needed to operate the locks of the Panama Canal. The drainage area of the Chagres before it reaches the Canal is about 1,320 square miles.

West of the Canal, rivers are short, with steep gradients. The Coclé del Norte rises in the Province of Coclé and flows north to the Caribbean. In the extreme northwest of Bocas del Toro the Changuinola waters the cacao- and abacá-producing areas of Panama. Flowing southward to the Pacific are the David, Chiriquí, Tabasara, San Pablo, San Pedro, and Santa María.

Climate Tropical

Panama's climate is tropical, the low coastal areas having average temperatures of 80° F., with high humidity. At the higher elevations of the interior the average temperature is 66° F. On the Pacific coast west of the Canal a severe dry season begins in December and usually lasts until the end of April. The same dry season exists on the Caribbean coast but with less severity. Average rainfall at Cristobal on the Caribbean is 130 inches, whereas at Balboa on the Pacific it is 69 inches.

Although the soil of Panama is fertile and climatic conditions favor agriculture, only a small part of the country is under cultivation. The most productive lands are found in two locations—the mountain valleys at high elevations and the alluvial soils along the coasts and rivers.

Crops Varied

Commercial crops of Panama consist of bananas, abacá, and coconuts. Production of bananas for export centers in the Province of Chiriquí in an area bordered by the Chiriquí River on the east and the Costa Rican border on the west. Shipments are made through Puerto Armuelles. Total exports of bananas from Panama in 1945 amounted to 2,530,000 stems valued at $2,010,000.

In 1944 abacá replaced cacao as Panama's second-most-important export. Climatic and soil conditions of the Almirante region of Bocas del Toro have proved most favorable for this fiber plant. Many thousands of acres in the fertile valley of the Changuinola are devoted to abacá plantations. Production of seed in 1940 was sufficient to inaugurate plantings in Costa Rica, Guatemala, and Honduras.

Although cacao trees grow wild in Darién and Coclé, plantations are concentrated in Bocas del Toro from Almirante northward to the border of Costa Rica. Cacao exports declined during the war because of scarcity of shipping and smaller production. However, during late 1945 and early 1946 volume of exports again showed an upward trend, increasing 40 percent during the first quarter of 1946 as compared to the same period of 1945.

Coconuts grow in different parts of Panama, but most of those entering trade are produced in the Territory of San Blas. The coconut palm is important to the people of that area, furnishing them food, drink, clothing, and shelter. Until the establishment of a vegetable-oil mill in 1939 Panama was an important exporter of coconuts. Exports dropped to zero in 1943 and 1944. In 1945 there were again exports amounting to almost 7 million nuts.

Among crops grown for home consumption are rice, corn, beans, yuca, sugar, plantains, and coffee. Rice is the chief item in the average Panamanian diet, and through government aid rice production is a growing industry. About 78 percent of the farms in Panama grow rice, principal areas being the "breadbasket" Provinces of Los Santos, Chiriquí, and Veraguas. Corn, formerly used only for animal feed but now second to rice as a staple in the human diet, is also grown chiefly in this same area. Coffee is produced throughout the highlands, though in amounts insufficient for local needs. Sugar production also does not meet local demands.

The cattle industry of Panama centers in the plains of Los Santos, Herrera, Veraguas, and Chiriquí. Pastures often fail during the dry season except in certain areas of Chiriquí where pasture lands are located in the river valleys, making irrigation possible. Large stretches of excellent grazing land are also found near Colón and Panama City.

Forests Important

Approximately half of the entire area of Panama is covered with luxuriant tropical vegetation including trees yielding cabinet and dye woods as well as building material. Many forests are trackless and unexplored. The region from San Miguel Bay south to the Colombian border in Darién Province is said to contain the finest and most extensive hardwoods in the country. Other forest products are rubber, tagua nuts, and toquilla straw. During the war Panama shipped to

(*Continued on back cover*)

Henry Meiggs, by Watt Stewart. 370 pp., illus. Duke University Press, Durham, N. C., 1946. Henry Meiggs has been called the "Yankee Pizarro" because of his daring exploits in Peru. Forced to flee for his life from California after the discovery of his participation in the "boiling San Francisco pool" of Gold Rush days, he went to Chile and later to Peru. During the years 1855 to 1880 Meiggs held a prominent place in the development of those two countries by his dauntless achievements as a successful contractor and manager of Chilean and Peruvian labor in the building of the Santiago-Valparaíso Railway in Chile and the Arequipa, the Oroya, the Arequipa-Puno, and several other railroads in Peru. This book is essentially the story of the building of these first principal railroads in Chile and Peru.

La Vid y Su Cultivo, by Jorge R. Christensen y Enrique Dragón Achard. 209 pp., illus. Editorial Sudamericana, Buenos Aires, Argentina, 1945. The author discusses the cultivation of the grapevine in Argentina--its multiplication, grafting, planting, and systems of pruning, watering, and fertilizing the vine.

Flora Fungosa Chilena, by Fernando Mujica R. and Claudio Vergara C. 199 pp. Ministerio de Agricultura, Santiago, Chile, 1945. This is a preliminary index of the hosts of the Chilean fungi, with bibliographical references for each.

Habla La Oveja, by Pablo Link. 125 pp., illus. Imprenta Ferrari Hnos., Bmé. Mitre Buenos Aires, Argentina 1946. An industrial engineer tells of the care of sheep in South America, in the form of a lamb telling its own story. The author hopes in this way to contribute to more humane treatment of sheep.

Peter Duck, by Arthur Ransome. 427 pp., illus. J. B. Lippincott Company, Philadelphia, Pa., 1946. This fourth impression of an earlier popular children's story is a Junior Literary Guild selection. The voyage of the children, with the uncle Captain Flint and the old sailor Peter Duck, to an island of the Carribees, replete with coconut palms, banana trees, and tropical hurricanes, makes good reading. It is the third book about the Swallows and Amazons—those boys and girls who love the water.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications write direct to the publishing agency given in each case.

GOATS TEST FEED

(*Continued from page 55*)

Interesting and important is the fact that chemical analysis shows dried banana leaf to contain 20 percent total protein. As the leaf used in the present trials contained slightly more than 4 percent total protein on the green basis it compares favorably with green alfalfa as regards total protein, according to data presented in Morrison's *Feeds and Feeding*. This fact has particular significance in El Salvador, where bananas continue to grow throughout the 6-months dry season when green feed is scarce. These experiments in feeding banana leaves to the goats indicate that green banana leaves might be an excellent protein containing roughage for growing calves as well as for other young animals.

The goats will also be asked to establish the value of oilseed byproducts and various forages which are available in El Salvador. These include such oilseed-cake meals as those of *Simaruba glauca* and *Moringa oleifera* (Lam.), and such forage plants as *Desmodium rensoni* (the alfalfa of the Tropics), tropical kudzu, and blue panic.

Productivity To Be Studied

The answer given by the goats to the question of the palatability and digestibility of coffee pulp and these other feeds, must be carried still further if the El Salvadoran farmer is to be given the best advice as to feeding practices. The feeding value for productive purposes must be determined in terms of some known ingredient of the ration, such as corn, or a well-known forage. Thus, the educated goats having pointed the way, the road will be open for feeding more intelligently the cows of El Salvador.

AGRICULTURE IN THE AMERICAS O. R. CARRINGTON, EDITOR

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U. S. GOVERNMENT PRINTING OFFICE: 1947

Gifts of the Americas

YERBA MATE

by CONSTANCE H. FARNWORTH

In our travels through Argentina we may see the Gaucho drinking his yerba mate through a *bombilla*, or slender tube, which is inserted into a gourd filled with the beverage, or we may visit highest society and see the beverage taken from a cup as we would drink our tea. The Argentineans are the world's greatest mate drinkers, sometimes partaking of this aromatic and stimulating beverage several times a day.

The yerba mate plant supplied the favorite beverage of the Guarani Indians before the Spanish conquest of Paraguay and the Portuguese settlement of Brazil. They called it *caa guazu*, the big or splendid plant. They showed the Jesuit fathers how to make a beverage of the mate by putting some of the powdered leaves in a clean dried gourd, pouring hot water over them, and allowing them to steep; then how to drink the concoction from a tube of cane or bone, with a sieve at one end to keep back the leaves. An early Indian custom was, and still is, to serve each stranger who entered their camp some of the tea from the gourd. The chief sipped some of the beverage through the *bombilla* and then passed the receptacle to the visitor, who drank from the same tube. Each in the camp did likewise until the beverage was consumed. For the visitor to refuse to partake of the contents of the gourd was considered an unpardonable rudeness.

The Jesuit missionaries early recognized the value of the product and in the seventeenth century introduced its cultivation into northeastern Argentina, where they developed flourishing plantations. In 1796 the Jesuits were expelled from this region, and their plantations destroyed. Extensive cultivation was not carried on again in the State of Misiones until 1903, but mate has now grown to be one of the greatest products of this Argentine area.

The leaves from which the best tea is brewed are gathered from a native plant of the species *Ilex paraguariensis*, which may be found in great quantities growing wild or on scientifically cultivated plantations. It may grow in the form of a tree or shrub and attain a height of 60 or more feet in the wild state or average between 12 to 30 feet when cultivated. From a distance it is very beautiful, resembling the orange tree or European laurel. It has whitish flowers and develops a fruit that is the size of a peppercorn, green at first, but gradually changing to a dark violet. The leaves are glossy green and rather hard and thick.

Harvesting of the leaves is best done from May to October, when they are in maximum development. At this time they also have a little better flavor and aroma and the trees are best able to recover from being stripped of their leaves. Primitive methods of harvesting prevailed for years in Paraguay and southern Brazil. The gatherers went into the forest and with a machete stripped the trees of the smaller branches. Then by a method known as *tatacu*, meaning fire hole, they dried the leaves on the branches, placing the branches in an excavation in the ground surrounded by bonfires until the leaves were dry. The dry leaves were beaten until separated from the small branches, and were packed into sacks and allowed to dry thoroughly before being packed again more tightly. They were transported to market by muleback or oxcart.

The leaves were used in earlier years in this crude form, known as *mate cancheada*, which consists of a mass of ground-up leaves mixed with twigs and bark. Now the *mate cancheada* is sent to a factory where it is heated, carefully sieved, and passed through blowers before being separated into grades for use. More modern methods are also used in curing, grinding, and packing the leaves.

Yerba mate is produced commercially in just three South American countries—Brazil, Argentina, and Paraguay. On account of heavy consumption in Argentina only Brazil and Paraguay export the product in important quantities. Production for the three countries in 1943 was about 373,000,000 pounds, and consumption for Argentina alone usually averages about 243,000,000 pounds annually. Imports of ground mate into the United States in 1943 were about 785,450 pounds.

Yerba mate as yet is not widely used as a beverage outside South America, even though it is reported to have certain food qualities and in taste is thought by some to compare favorably with our regular tea, having the same somewhat bitter flavor. With the habitual mate consumers of South America, however, the drink is very popular. A cup of hot yerba mate is described as "fit to satisfy the most exacting palates."

THE RIVERS OF PANAMA

(*Continued from page 57*)

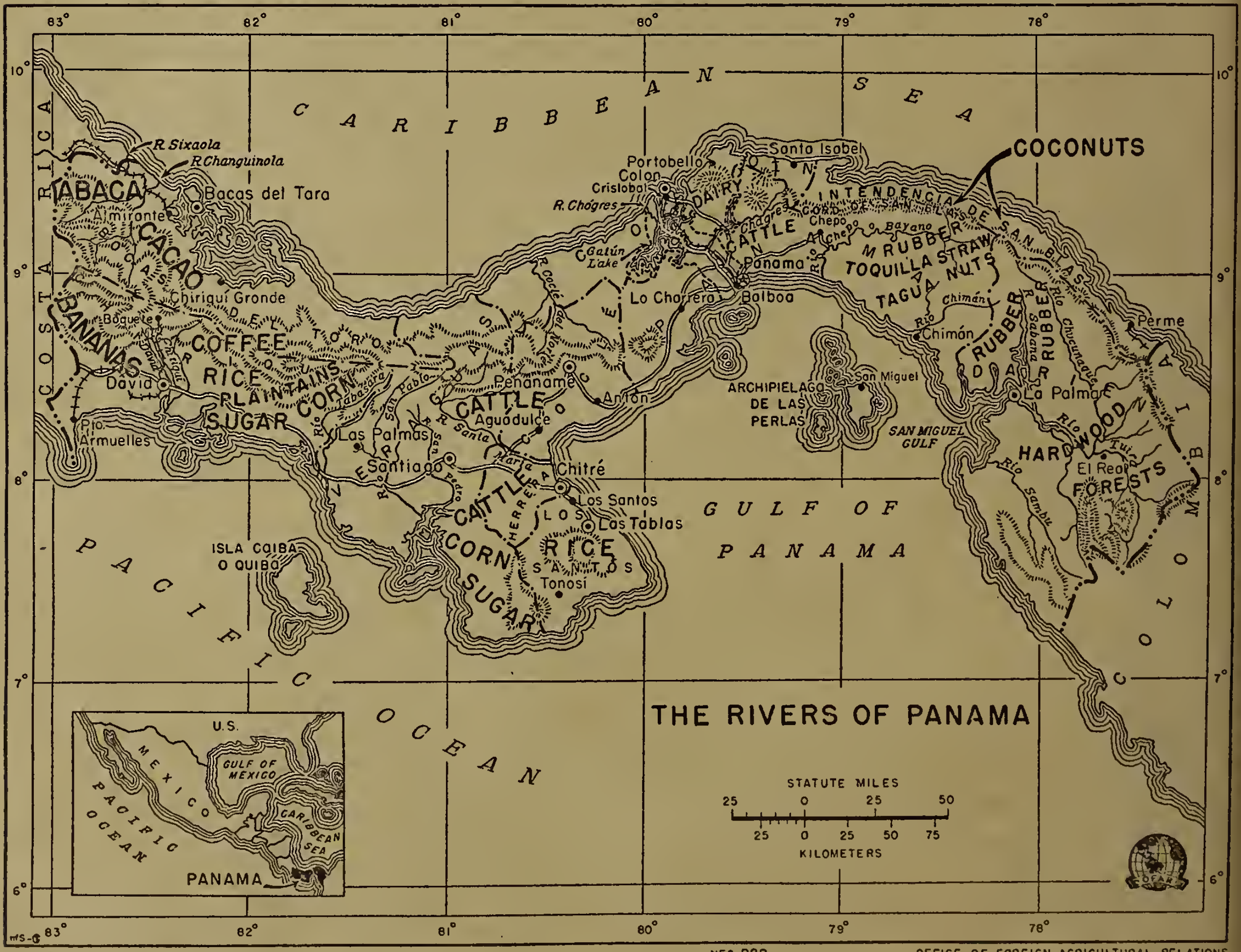
the United States small amounts of crude rubber, procured mostly from the forests along the Chucunaque, Sabana, and Sambu Rivers, all in Darién.

The rivers of Panama are too small to lend much assistance to the transportation of the country, only the Tuira in Darién having commercial importance. The Canal makes available the best of external transportation, but lack of highways and railroads in the interior makes movement of the country's products to port difficult.

Road building is complicated by the ruggedness of the terrain. The most important roads are the National Highway extending from Chepo, 40 miles east of Panama City, to the Costa Rican border, and the highway which parallels the Canal.

The Panama Railroad, maintained by the United States Government, runs between Panama and Colón but has no direct relationship to the country's agriculture. The small but efficient National Railroad of Chiriquí Province depends almost entirely on agriculture and related products for its existence.

Much of the future development of agriculture depends upon extension of all-weather roads into fertile but now inaccessible regions. Such roads would allow the products of these areas to move more freely to local markets, and production of foodstuffs now imported would be encouraged. Wider distribution of imported supplies and equipment could aid appreciably in raising present living standards.



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Agriculture IN THE Americas

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U.S. DEPARTMENT OF AGRICULTURE

April–May 1947

NAMES & NEWS

Theodore J. Martin Goes to Panama

Theodore J. Martin, Technologist, U. S. Forest Service, left in March for the Canal Zone where he will install aircraft wing-cell exposure specimens and make routine inspection of previous installations at the Canal Zone Biological Area, Barro Colorado Island. Mr. Martin is making the trip as part of a cooperative study between the Bureau of Aeronautics, U. S. Navy Department, and the U. S. Forest Products Laboratory at Madison, Wisconsin.

●

Brazilian Executive To Study Insecticides

Jairo de Almeida Machado, General Manager of the *Instituto Medicamente Fontoura and Fonto-Quimica,* São Paulo, Brazil, has come to the United States for 1 year to make a special study of insecticides.

●

Allard Returns To Dominican Republic

Howard F. Allard, who was in the United States during the past winter on leave, has returned with Mrs. Allard to the Dominican Republic. For the last 4 years he has been carrying on experiments with *Hevea*-rubber plantings under a cooperative agreement between the USDA Bureau of Plant Industry, Soils, and Agricultural Engineering, and the Secretary of State for Agriculture, Industry, and Labor of the Dominican Republic.

●

Douglas Blackwood Studies U. S. Bureaus

Douglas Blackwood, of the Dominican Settlement Association, Sosua, Dominican Republic, recently visited the United States to make a special study of the work of the USDA Bureaus of Animal Industry and Dairy Industry.

Rands and Mackinnon Inspect Rubber Projects

Robert D. Rands, Principal Pathologist, Division of Rubber Plant Investigations, BPISAE, returned to Washington in March following a trip to Colombia and Peru, where he inspected the work of the cooperative rubber programs being carried on between those countries and the United States. Dr. Rands was accompanied on part of his trip by *William Mackinnon,* also of the Division of Rubber Plant Investigations, who has for some time been working on the rubber program in Colombia. It is planned that Mr. Mackinnon will give a portion of his time to the Peruvian project from now on. There has been considerable expansion of rubber work in both Colombia and Peru.

●

Francisco Planas Visits U. S. Manufacturers

Vet. Dr. Francisco Planas, Municipal Veterinarian, *Isla de Pinos,* Cuba, has been sent to the United States by his Government to make a study of methods of manufacturing biological products.

●

Arthur W. Bechtel To Visit Brazilian Rubber Experiments

Arthur W. Bechtel, In Charge of the Cooperative Rubber Field Station, Martrane, Haiti, will visit Brazil next month for the purpose of studying clone-improvement work at the *Instituto Agronômico do Norte,* at Belém, and to discuss coordination of rubber-breeding work in Haiti and Brazil. Representatives of the Division of Rubber Plant Investigations, USDA, point out that an important factor in encouraging a permanent self-sustaining rubber producing industry in the Western Hemisphere is the development of new strains of rubber trees which are high yielding and disease resistant. Many of the best-yielding clones to be used in the breeding program are susceptible to South American leaf blight and must be grown in disease-free areas. Because of its strategic isolated position, Haiti is considered relatively secure against early encroachment of leaf blight and will be a center for breeding work involving the use of high-yielding but disease-susceptible strains.

Agriculture IN THE *Americas*

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Bananas of the American Tropics

North American households are familiar with the large yellow banana known as Gros Michel. This is only one of many exotic varieties in the tropical Americas which have a number of important uses to the people who raise them.

by DALE E. FARRINGER

To the North American the banana is a tropical fruit to be eaten fresh as a between-meal fruit, or sliced in desserts, and salads, on cereals, and in banana cream pie. To the Latin American it is a staple food, occupying an important place in almost every menu and used in dozens of different ways. For these various uses, Latin Americans employ from 5 to 15 different varieties of bananas, both ripe and green, most of which are unfamiliar to the North American.

Besides being eaten raw, bananas and their near relatives, the plantains, are boiled, fried, or baked and served as a vegetable or as a substitute for potatoes and other starch foods. Often they are boiled and served along with beans, rice, and tortillas. When peeled, sliced, fried in lard, and salted, they resemble French fried potatoes, but they retain their banana flavor. Dried green bananas or plantains are sometimes ground into flour. Although the preparation of banana bread is not recommended without the addition of wheat flour, powdered bananas can be used in making gruel, soups, and puddings.

Sometimes our Latin American neighbors preserve bananas, like figs or raisins. Sliced ripe bananas are dried in the sun or in an oven until covered with a deposit of white sugary powder from their own juices. During the war these "banana figs," dehydrated by modern methods, were shipped to the United States from Mexico.

On large plantations of Central America green bananas classed as rejects because of bruises or substandard quality are frequently fed to work animals and other livestock. Mules like bananas so well that, when they are carrying bunches to railroad sidings for shipment, nose baskets are often necessary to prevent these animals from mutilating a bunch by nipping off a hand or two of the fruit. Over-ripe fruit is sometimes salvaged and fed to poultry.

Alcoholic beverages have been made from bananas. Some years ago banana whisky experiments were conducted in Guatemala. Banana wine from fully ripe fruit allowed to ferment in water was known in the West Indian Island of Barbados as early as 1657. Denatured alcohol from bananas is an age-old possibility.

Dehydrated banana flakes and flour packed and shipped to the United States from Mexico, Central America, and Brazil, were seen on grocers' shelves in this country during the war. According to report, 300 tons of bananas were required to produce 30 tons of flakes. Perhaps the most novel use for bananas occurred a few years ago when a sizable quantity was used as a substitute for grease in launching ships.

Many Kinds of Bananas

Botanically, the banana and its relatives constitute the genus *Musa* of the family Musaceae. The *Musas*, with their hundreds of species, are the tallest herbaceous plants—large woodless plants without trunks—aside from the bamboos.

The important edible banana of commerce is the species *Musa sapientum*, fruit of the wise men, so named because of a legend that "the sages of India reposed in its shade and refreshed themselves with its fruit." Of this species, there are from 150 to 200 known varieties, nearly all of which are food producers.

Gros Michel: The variety of *Musa sapientum* which has attained greatest commercial importance is the Gros Michel, called also the Jamaica, Martinique, and Roatan banana. It surpasses all its sister varieties because it produces the largest bunch of fruit of excellent flavor. It is comparatively easy to transport, owing to the compactness of the bunch and the thick skin of the fruit that can withstand somewhat rough handling. In addition, the Gros Michel possesses excellent ripening qualities and has an attractive yellow color when ripe. Its familiar flavor and smooth texture are known to almost every North American.

The usual marketable bunch or stem of Gros Michel has from 8 to 10 hands, or clusters, each containing approximately 18 fruits, called fingers, making from 150 to 180 bananas in all. A few years ago a bunch containing 22 hands was reported in Panama. Under ideal conditions annual yields of 400 bunches to an acre have been produced, although 300 bunches is considered the more representative figure on large improved plantations where irrigation, fertilizers, drainage, and spraying operations against the leaf disease sigatoka are employed. Unimproved banana farms average 150 bunches or less to an acre annually.

Gros Michel plants vary from 18 to 25 feet in height, but on rich river bottom lands of Central America they sometimes reach 30 feet or more. Nine to 12 months after planting, the first crop is ready for harvest on a commercial plantation.

Fruit is never allowed to ripen on the plant, as the skin bursts open and the pulp falls prey to insects and birds. In addition, the pulp becomes granular in texture, and the flavor is less palatable. Bananas are always cut green but at varying stages of maturity depending upon the ultimate destination. If the shipment is for European consumption, greener fruit is cut than that intended for the United States and Canada.

Claret: Another variety of *Musa sapientum* is the Claret or Red banana, variety *rubra*, found growing in many parts of the Tropics, often as a shade plant on coffee plantations. The color of the skin is a purplish red, but as it ripens it becomes paler and even tinged with yellow. Sometimes freak bunches appear with some fingers red, others yellow, and some striped. Before the war some shipments of this variety were sent to the North American market. Owing to its color, the fruit is especially appropriate during the Yuletide season. Red bananas are preferred during any season by a large group of consumers in California and are imported chiefly from Panama. Although their flavor is similar to that of the Gros Michel, the texture is rather gummy. Bunches are smaller, with fewer hands and fingers.

Lady Finger: One of the best eating bananas, popular in Latin America, is the Lady Finger, variety *champa* of *Musa sapientum*, also called Golden Early, Rose, or Date banana. Because of the smallness of the fruit it is known in Mexico as *ciento en boca*, meaning hundred in the mouth. This popular name, however, is not an accurate description, even though this is the smallest variety, as the fruit is from 3 to 4 inches long. In Ecuador this banana is called *orito*, or little golden fruit.

The delicate sweet flavor, kid-glove peel, and dainty appearance make this yellow banana a delicacy in countries where grown, but in spite of the compactness of its 300 to 400 fingers in a bunch it is difficult to ship because its unusually thin skin is easily bruised. For shipping, the hands must be separated from the stem and packed carefully in crates. In addition to its bruising, the fruit has a tendency to drop from the stem as it ripens, causing considerable loss.

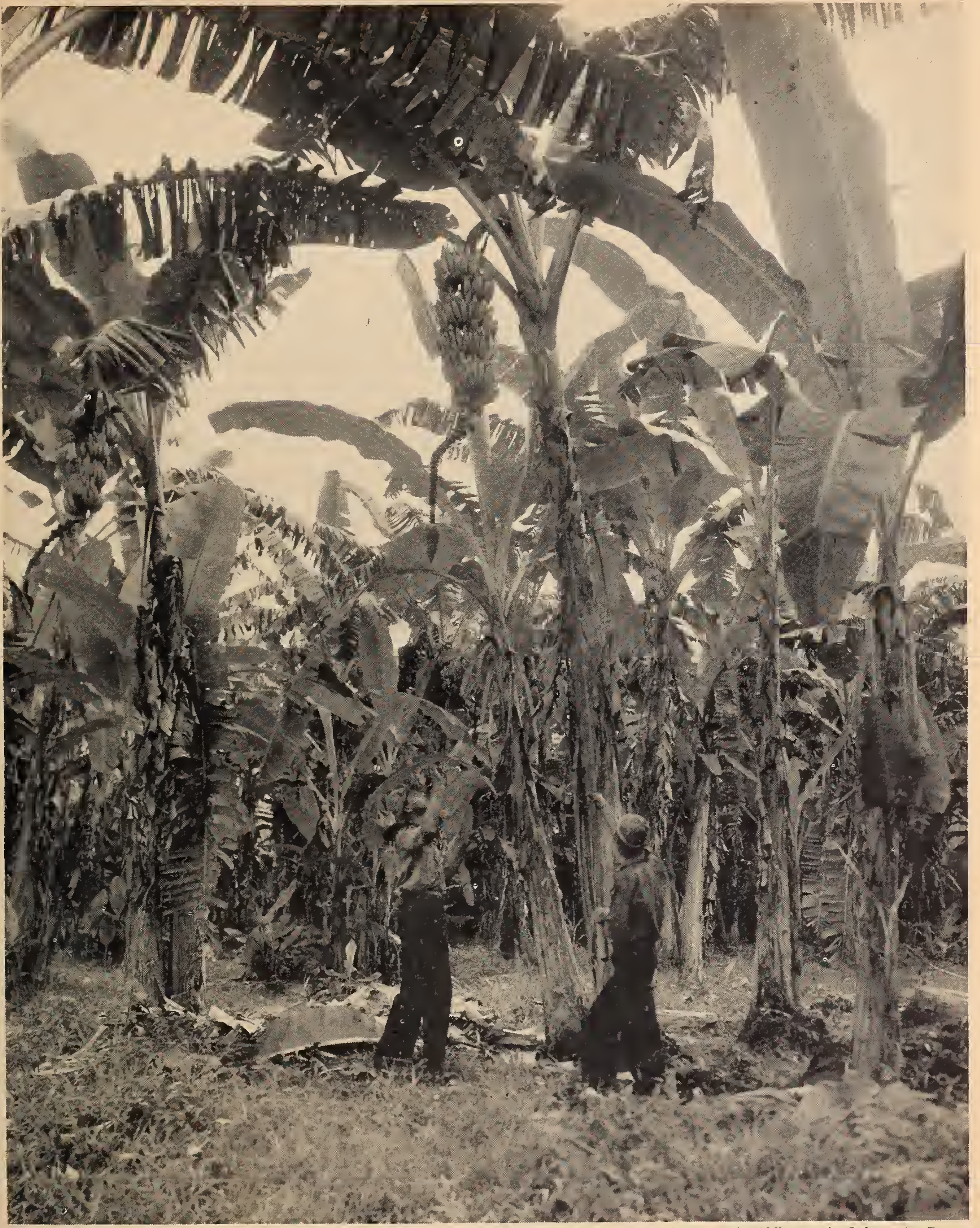
Apple: An acidulous-flavored banana, somewhat suggestive of a mellow apple, is the *Musa sapientum* var. *cubensis*, or Apple banana. The fruit is smaller and plumper than the Gros Michel, is about 4 to 5 inches in length, with a thin peel, and is usually eaten raw. The ripe pulp has an odor suggestive of apples and a rather granular texture. Like the Lady Finger, it is difficult to transport and is not found in Northern markets.

Cavendish: The banana which ranks second in commercial importance after the different varieties of *Musa sapientum* is the variety *cavendishi* of the species *M. nana*, known popularly as Cavendish or Dwarf.

This variety, known in commerce also as Chinese or Canary banana, is more important in southeastern Asia, lands of the central Pacific Ocean, Africa, and the Canary Islands than in the Western Hemisphere. The plant, usually 5 to 7 feet tall, produces a huge bunch of bananas for its size. The fingers are sometimes as

(*Continued on page 76*)

Dale Farringer is a member of the Office of Field Service of the U. S. Department of Commerce with headquarters in San Antonio, Texas. Prior to this he served a number of years in Latin America, his most recent assignment being Assistant Agricultural Attaché, American Embassy, Rio de Janeiro, Brazil.



Courtesy of Middle America Information Bureau

Harvesting Gros Michel bananas on a Costa Rican plantation. This variety has attained greatest commercial importance because it is comparatively easy to transport. Its texture and flavor make it a general favorite.

Training Tropical Agriculturists

by WILSON POPENOE

In March 1946 *Escuela Agrícola Panamericana* graduated its first class. The school is located not far from Tegucigalpa, the capital of Honduras. It was founded by the United Fruit Company, as part of a program of cooperation in the agricultural development of the tropical American republics.*

This Company has paid all costs of the school. It has expended more than $750,000 in purchasing land and developing the physical plant. It provides annually about $175,000 for maintenance and is building an endowment fund which now totals more than $1,500,000.

Visitors to the school usually ask these questions: What are the objectives of *Escuela Agrícola Panamericana?* How do you select your students? What is the curriculum? What are the boys going to do when they graduate? We are able to answer the first three, and we are beginning to get some ideas regarding the fourth.

Objectives of the School

Our objective is the training of efficient tropical agriculturists, men who know how to do all of the many things which have to be done by a farmer, because they have actually done them, and who know why they have to do them in a certain way, because they understand the basic principles of tropical agriculture. We want these agriculturists to be imbued with a patriotic desire to assist in the agricultural development of their respective countries and to appreciate the fact that Pan Americanism is not a rhetorical term but something which has a very real meaning to all of us.

Students Carefully Selected

During the past 4 years we have received annually from 300 to 400 applications for scholarships, from boys who live all the way from Mexico to Argentina. We can take in only 60 new students each year, since the capacity of the school is 160, and the course occupies 3 years. Naturally a few drop out before graduation. We limit the scholarships to Latin American republics in the tropical zone. At present we have students from Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Ecuador, Peru, Venezuela, the Dominican Republic, and Cuba.

A boy must apply personally, in his own handwriting, and give us, in addition to a photograph, complete details regarding his nationality, age, background, previous education, and his interest in agriculture. Then we check up on him, in most cases by means of

The 1946 graduating class of the Pan American Agricultural School in Honduras contained 63 students.

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* *See* "Escuela Agrícola Panamericana," by Wilson Popenoe, in the September 1944 issue of *Agriculture in the Americas.*

Biology is one of the important classroom subjects taught at the school.

an interview carried out by a member of the staff who visits every year the countries where the boys live. If the applicant meets with approval, the boy then has a thorough physical examination, carried out by a physician appointed in each country by the school.

If he is accepted by the physician, the boy packs his bag, says good-by to *mamacita*, and boards an airplane for Tegucigalpa. If we have been convinced that his family cannot pay his fare, we pay it for him.

At present we are accepting students only between the ages of 17 and 20. They must have had primary education. Sometimes they have had more. This year there are some 15 *bachilleres*—high school graduates—in the student body. It does not make much difference, for what the boys get here usually has not been covered fully by other schools. At the start we took boys from 15 to 19, but we now believe that graduates should be of mature and responsible age, as many of them will have to look for jobs, and too-young boys cannot get them.

Practical and Classroom Work Included in Curriculum

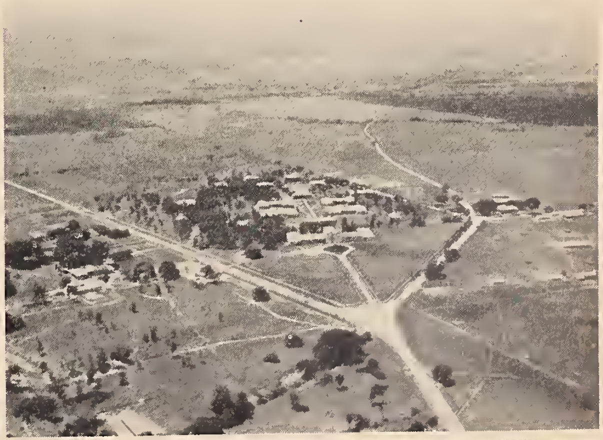
Practical work in the three departments of horticulture, field crops, and animal husbandry occupies the forenoons and comprises somewhat more than 50 percent of the curriculum. Classroom work takes up the afternoons, 5 days a week. To show just what a student does, let us take a hypothetical example:

Alfredo Lopez arrives at the Tegucigalpa airport from his home on a small farm near Heredia, Costa Rica, and is taken out to the school, which lies, some 25 miles away, in a fertile valley at 2,500 feet elevation, where climate and soil are representative of conditions generally in Central America. In one of the four dormitories he is assigned to a room with another student—of his own choosing if he has any friends among the group.

He rises in the morning at the first bell, 5:30. He cleans up his room and goes to breakfast in the school dining hall. At 6:30, dressed in blue jeans, he reports for duty. During his first year he works in the horticultural department, where he learns to grow vegetables of many sorts, to graft, prune, and fertilize fruit trees, and to fight insects and plant diseases. During his second year he works in the department of field crops, where, under the direction of Luis E. Morcillo, he grows potatoes, rice, corn, beans, sugarcane, and many other staples. Particular attention is given to experiments with new crops, for we believe in diversification and the development of products other than the standard ones such as coffee, corn, and sugar. During his third year he is in the department of animal husbandry, where he milks cows and makes butter and cheese, learns to treat the common diseases of cattle and horses, to butcher and cut meat, and to raise pigs and chickens.

No matter in which department he is working, Alfredo Lopez comes back to his dormitory at 11 o'clock, takes a shower, changes to his khakis, and has lunch. Then he has an hour for his siesta.

At 1 o'clock he goes to his classes. During the first year he studies English—Basic English—taught by Allen B. Arnold, who was trained in this method at Harvard. He has a "refresher" course in mathematics, because we find that 90 percent of the boys



Courtesy of T. B. Williamson

Air view showing the extensive acreage of the school grounds and farm.

Dr. Popenoe has a wide acquaintance with agricultural conditions and problems in Latin America. At one time he served with the Offices of Foreign Plant Introduction, and Foreign Agricultural Relations, U. S. Department of Agriculture. He has been Director of *Escuela Agrícola Panamericana* in Honduras since it was established.

Practical work in animal husbandry is part of the course.

who come here are weak in the practical applications of this science. He has, also, a thorough course in elementary biology, taught by Archie F. Carr, who came to us from the University of Florida.

During his second year he again studies English, the most popular subject with our students. They need it particularly, as most of our text and reference books are in this language. He has a very elementary course in physical sciences—one semester of agricultural chemistry and one of physics. A course in tropical crops begins with the principles of agriculture, takes him through a consideration of the major crops, and ends with a discussion of new crop possibilities. Jaime Villegas, of Colombia, and the writer give this course.

In his third year he devotes much attention to the study of animal husbandry, under the direction of Henry G. Hogaboom, Assistant Director of the school, aided by José Blas Henriquez and Carlos Herrero, both of whom were trained in the United States. He has a course in farm management and another in rural engineering. The latter consists mainly of practice in running levels and measuring land, planning drainage and irrigation systems, learning how to make brick and tile and build farm roads. He has some sound training in forest conservation and management under Paul J. Shank, formerly of the U. S. Forest Service.

Students receive much practical experience from working in the fields and gardens of the school.

During all this time Alfredo Lopez is housed, clothed, and fed by the school. He receives medical and dental attention, and his hair is cut regularly on a 3-week cycle. We graduated a number of boys last year who had not received a cent from home since the day they arrived here. Others have spending money in limited amounts from their families, and with this they repair to the Club Panamericano after the termination of their studies at 4 o'clock, to indulge in soft drinks and *dulces* (confections) prepared by Doña Moncha. Others spend the 2 hours between 4 and 6 playing baseball, basketball, and soccer.

After supper, there is an hour during which the air is filled with the music of guitars, or the marimba, and then a study hour comes. At 8:45 lights are out, and Alfredo Lopez sleeps the sleep of a healthy youth who has put in a full day.

After Graduation, What?

At this writing, only 63 of our graduates have been away from the school for a sufficient length of time to give us an idea of what they are going to do. About half of these have gone back to their own farms. This is about the proportion of those, so far, whose families are on the land. We can change this situation, if experience shows it to be desirable, by taking more boys from the farm and fewer from the towns and cities. But we believe there is a real field of usefulness for many of our graduates as managers of agricultural properties and as extension workers in the ministries of agriculture and agricultural departments of these countries. The fact that we do not give our graduates a title or degree, merely a diploma, may debar them from some positions. In general, however, these are not the sort of positions we want them to occupy. We want them to stay close to the land. We do not feel that the training we give them merits a degree, any more than does the training received in an agricultural high school or vocational institution in the United States.

Throughout tropical America there is not only ample room, there is a crying need, for soundly trained agriculturists, familiar with the climates, soils, and crops of this part of the world, and conversant with the basic principles of agricultural science. Tropical America itself would seem to be the logical place to train such men, and it is the hope of *Escuela Agrícola Panamericana* that it may play a useful role.

Coffee Is Gold For El Salvador

On the slopes of a chain of volcanoes extending the length of the country grows the popular El Salvadoran shade-grown blending coffee. Most of the crop comes to the United States.

by JULIAN C. CRANE

Coffee blenders in the United States like to use El Salvadoran coffee in their blends because of its acid flavor and pleasing aroma. It gives what the commercial tasters call "punch" to a blend. The best coffee that El Salvador produces is classified as hard-bean, with a characteristic bluish-green color and relatively hard texture. There is a progressive decrease in the so-called acidity and flavor of coffee from this hard-bean down through the classifications of semihard, prime, and good washed, generally corresponding to a progressive decrease in the altitude at which the coffees are produced.

Slopes of volcanoes that mushroom in chain-like fashion from one end of El Salvador to the other, furnish ideal soil and environmental conditions for the growing of coffee. In 1839, a Brazilian school teacher began making commercial plantings on those slopes, and the industry spread like wildfire, until today, although El Salvador is only slightly larger than the State of Maryland, it is the world's third-largest coffee producer.

In comparison with Brazil, the leading coffee producing country of the world with its more than 8 million acres of coffee land, the 268,000-acre coffee-producing area in El Salvador is relatively small.

Shade is important in coffee growing in El Salvador. These seedlings are being grown under a grass shelter in a shade experiment.

On the other hand, it looms large when one considers that it comprises slightly more than one-fourth of the cultivated land in the Republic. The agricultural population is largely dependent upon coffee, and most business enterprises revolve around it. Success or failure of the coffee crop has vital repercussions on the life of everyone.

Industry Important In Country's Economy

From 1860 to the end of the nineteenth century exports of coffee from El Salvador sky-rocketed from 1 to 76 percent of the total export value of the country. By 1930 coffee exports comprised 90 percent of the total, but the percentage dropped to 74 in 1941 because greater attention was given to other crops. During the last 5 years there has been a slight upward trend, and coffee has furnished 82 percent of the total export value.

Although coffee is grown in all 14 Departments of El Salvador, the largest area is on the slopes of volcanoes in the western Department of Santa Ana. Several plantations in this region, interestingly enough, are dusted intermittently with ashes from the active volcano of Izalco. The next-largest coffee area is the west-central Department of La Libertad, followed by the Department of Usulután in the eastern part of the country.

The major portion of the crop is grown between 1,500 and 4,500 feet above sea level, though some grows as high as 5,500 feet. Altitude is an important factor in the quality of coffee. Because the tree cannot withstand frost, its cultivation is restricted to regions having a mean annual temperature of about 70° F. In El Salvador, temperature conditions, the annual rainfall of 70 to 80 inches, together with the rich, friable, and well-drained volcanic soil make ideal conditions for producing coffee with relative ease.

The Coffee Tree

Coffee is a small, broad-leaf evergreen tree or shrub which reaches a height of 20 feet. It has a distinctly dimorphic branching habit, the main stem producing opposite leaves at each node and eventually sending out primary laterals, in pairs and opposite, from the axils of each leaf. The primary laterals also produce leaves at each node and in turn may send out secondary laterals from their leaf axils, but no lateral can ever produce an upright. Similarly, the upright stem is unable to reproduce new laterals where primary laterals may be injured or broken off; instead, new uprights originate immediately below the points of origin of the destroyed laterals. For these reasons, in vegetative propagation of coffee only cuttings from uprights can be used; otherwise the resulting tree would be of low-growing and spreading habit.

Flowering and fruit production generally occur only on lateral wood made the year previous. A cluster of from one to six flower buds is produced in the axil of each leaf. A bud generally consists of four flowers borne on short stalks attached to a main stalk, two above and two below in alternate pairs. The small white flowers, having a fragrant scent reminiscent of orange blossoms and gardenias, are so numerous that when a tree is in full bloom it appears to be laden with snow. Blossoms persist for about 2 days. Depending upon the rains, coffee in El Salvador usually has three flushes of blossoms. The first, relatively light, occurs in the first half of April; the second is heavy and comes about 3 or 4 weeks later;

Coffee-drying patios and buildings of the Hacienda Puerta de la Laguna, Santa Tecla, El Salvador.

the third, generally light, takes place around the last of May.

In 7 to 9 months, depending upon altitude and other environmental factors, the fruits turn red and reach the size of cherries, somewhat ellipsoidal in shape. A normal coffee cherry contains two locules, or cavities, in each of which is a seed or coffee bean with its parchment covering. The beans are flattened on the side where they grow adjacent to each other.

Cultivation Methods

Instead of selecting seed from trees with records of high productive performance kept for a period of years, many coffee producers in El Salvador gather their seed from trees bearing a good crop in that particular year. The largest ripe cherries are selected from trees 8 to 10 years old. The cherries are carefully pulped and the beans, or seed, washed by hand, with care not to break the parchment covering. The clean seed is then dried in the shade and stored a short while before planting.

Contrary to the Brazilian method of planting the seed in the spot where the mature tree will stand,* all Salvadoran coffee is started in nurseries. The *semillero*, or seedbed, is made in the best land on the finca and near a water supply. Seeds are planted during March and April about an inch deep in rows 4 to 6 inches apart. Germination takes place in from 6 to 8 weeks, and the seedlings are then transplanted to the *almaciguera*, or nursery.

The *almaciguera* is constructed near the *semillero* and is large enough to allow placing of the plants not less than 1 foot apart. Here Salvadoran ingenuity and the art of improvising are remarkably displayed. Occasionally barbed wire is used as overhead supports to hold the branches of trees which are laid across them to shade the plants, but more often only materials provided by nature on the finca are used. The branches and cross pieces, which rest on posts, are tied in place with long strips of fiber from banana or palm leaves.

Tools are also made from materials produced on the finca and are fashioned into implements by the keen-edged machete of the Indian laborer. For marking the 1-foot intervals where seedlings are to be set a triangular piece of wood called *triangulo* is used. Through use of this marker seedlings are planted on the diagonal. The *zanco*, an implement used for making the holes, is made from a trunk or limb of a coffee tree. It is about 5 feet long and has a protrusion or stub of a branch a foot or so from the pointed end. In making the hole, the operator places this pointed end in the place indicated by the *triangulo* and forces it into the ground by pressing his foot on the protrusion. Another implement is the *espatula*, a tapered piece of wood about 2 inches wide and 10 to 12 inches long, curved at the end opposite the point to form a handle. As the coffee seedling is placed in the hole with one hand, the *espatula* in the other hand is inserted into the soil near the hole and pushed toward the plant, thus pressing the soil into contact with the roots.

Typical El Salvadoran coffee plantation showing how coffee trees are grown under large trees for shade.

Transplanting from seedbed to nursery is done after the rains have started, the latter part of May or June. At this time seedlings may be in the *concha* (shell) or *mariposa* (butterfly) stage, meaning that the two cotyledons have opened and separated from each other, or in the *naranjito* (little orange tree) stage, meaning that the first true leaves have developed. Some planters prefer to wait for the *naranjito* stage.

Seedlings remain in the nursery until June or July of the following year. About a month before the trees are to be transplanted to their permanent sites all shade is removed in order to harden the plants. The trees are carefully dug, roots remaining encased in a cylinder of moist dirt called a *pilón* or *queso*, 6 to 8 inches in diameter and from 1 to 1½ feet long. One or two trees are cautiously placed in broad, flat baskets lined with grass or leaves and are carried on the

The author is Assistant Professor of Pomology at the University of California. Before going to California Dr. Crane conducted research work for the Office of Foreign Agricultural Relations in collaboration with the Cuban Ministry of Agriculture and the Cooperative Agricultural Experiment Station in El Salvador.

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* *See* "Brazilian Coffee Goes to Market" by Henry W. Spielman in the May 1945 issue of *Agriculture in the Americas.*

Experimental plantings of coffee at Santa Tecla which are being used to test varying degrees of shade and organic and inorganic fertilizers.

heads of women. Holes to receive the plants are approximately 2 feet square and from 2 to 3 feet deep. Some growers dig the holes a year or more in advance and during that period rake leaves and decomposed vegetable matter into them. Or, holes may be prepared shortly before transplanting time, and topsoil, deposited in other places on the finca by erosion, is brought back in baskets to fill the holes.

A grower figures on about 1,000 trees to the *manzana* (1.726 acres). Except in the establishment of new fincas, however, the young trees take the place of scattered old ones which have been removed because unproductive. As a result of this practice, a particular block of coffee may contain trees ranging in age from 1 to 30 or 40 years.

Even though 95 percent of the coffee is produced on slopes, few growers use modern soil conservation methods. Some coffee is grown on what approximates bench terraces, but these do not follow the contour. Cover crops and barrier plants are not used in sufficient quantities. If the production of El Salvador's coffee trees is to be maintained, soil conservation measures must be adopted without delay. It is good to know that considerable discussion and interest are in progress about such practices.*

An old practice of cultivation in El Salvador is to rake weeds and fallen leaves into fertilizer holes, called *hoyos de abonos*, particularly just before harvest. These pits, often 8 feet in length and 2 feet deep by 2 feet wide, are dug between rows of coffee trees. They are said to provide places for the decomposition of organic material, reduce soil erosion, conserve moisture, and provide better soil aeration. Scientific experimentation is now testing the benefit of this practice.

Perhaps the greatest divergence from Brazilian methods of coffee production is that El Salvador, like other Central American countries, produces all of its coffee under shade to protect it from wind and sun.* For many years the most popular shade tree was madrecacao (*Gliricidia sepium*). But because this tree is deciduous and sheds its leaves in January during the dry season, a critical period for coffee under El Salvadoran conditions, it has been largely replaced by such trees as pepeto de río (*Inga spuria*), pepeto negro (*I. leptoloba*), and pepetón (*I. edulis*). These are leguminous trees and are believed to enrich the soil by the fixation of atmospheric nitrogen in the root nodules. Average distance between shade trees is 40 feet, resulting in about 300 trees to the *manzana*. When a shade tree reaches the age of 10 or 12 years, it is generally removed and shade is furnished by another tree previously planted near the same site. Most of the fuel used in the kitchens of the country comes from shade trees on the coffee fincas. On a few fincas shade is provided by natural forest.

Harvesting and Processing

Harvesting begins at the lower altitudes about the middle of October and continues at the higher altitudes until February. As only ripe cherries are picked, two to four pickings are required. The crop is hand picked by migratory workers, placed in bags, and transported to the *beneficio*, or mill.

At the mill the cherries are poured into a float separator to remove defective fruits and foreign matter and then pass into a pulping machine, which removes the outer skin and part of the pulp from the beans. From here the beans pass to fermenting tanks, where during the next 12 to 24 hours the remaining pulp or glutinous substance is fermented from the parchment-like covering of the bean, and they then pass through a series of washing tanks. When well cleansed, the beans are spread on drying courts for about 8 days. The dried product is known as *café en pergamino*, or coffee in parchment. To remove the parchment, the beans are passed through a shelling machine, then through a polisher, and emerge ready for sacking as *café en oro*, or coffee in gold.

Coffee is, indeed, the wealth of the country. From the humblest Indian laborer to the wealthiest plantation owner, every person daily watches and guards the trees that bear the famous shade-grown coffee of El Salvador. It is gold, all gold, for El Salvador.

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* *See* "Saving Puerto Rican Coffee Soil" by Emery A. Telford in the August 1946 issue of *Agriculture in the Americas.*

* *See* "Dominican Coffee" by Rollo P. Stovall in the May 1946 issue of *Agriculture in the Americas.*

Cibao Valley—Food Basket Of the Dominican Republic

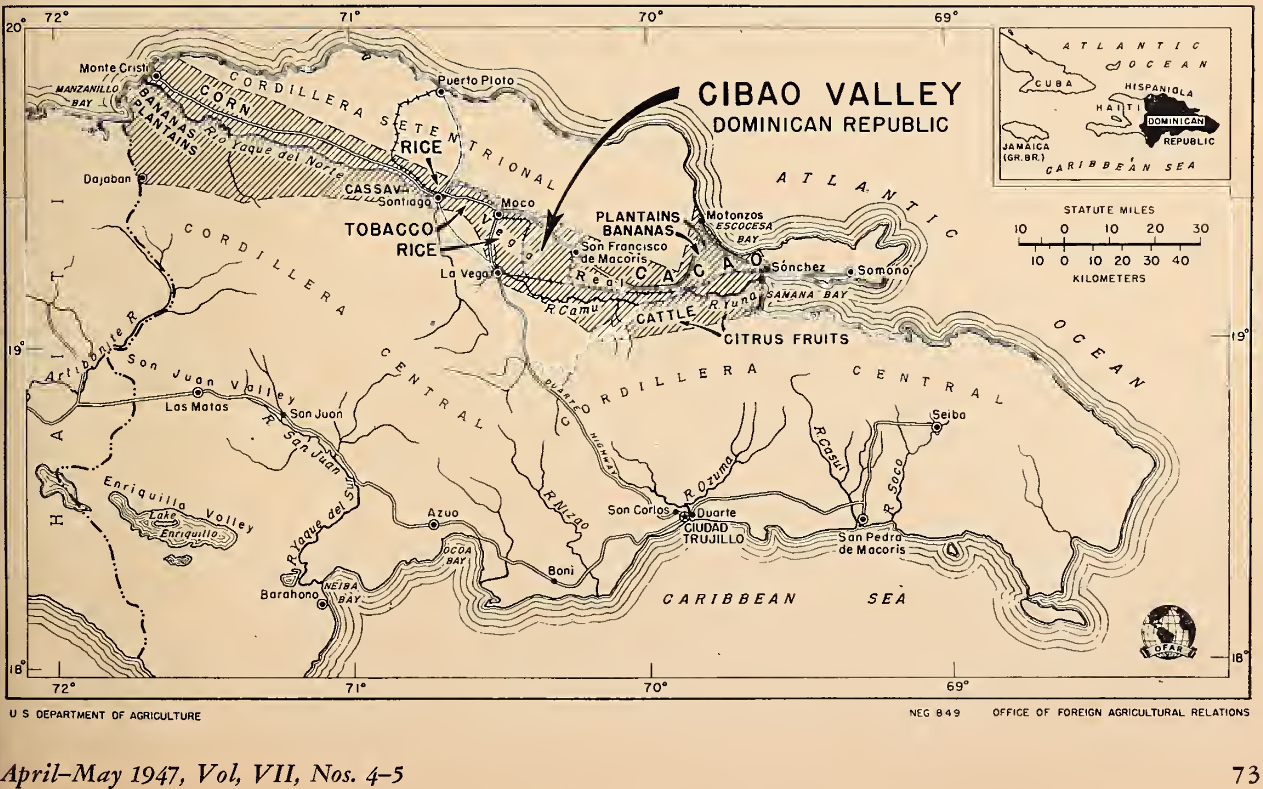
Stretching across the northern part of the Dominican Republic is the fertile and densely populated Cibao Valley. The local people call it la tierra de María Santísima—heavenly land.

by ROLLO P. STOVALL

Almost one-half of the 2 million inhabitants of the Dominican Republic live in the fertile district known as the Cibao Valley. It is the most productive and densely populated area of the country. Producing bountiful harvests of cacao, rice, tobacco, corn, plantains, bananas, and other fruits, it is the agricultural backbone of the Republic except for sugarcane, the cultivation of which is concentrated in the southern coastal plain. Its people, called Cibaeños, are proud and industrious and are prominent in the country's economic and political affairs.

When a visitor traveling northwest on the Duarte Highway from the capital, Ciudad Trujillo, formerly called Santo Domingo, approaches the town of La Vega, he is in the Cibao. It is in reality the valleys of two river systems—the Río Yaque del Norte, which flows westward toward Monte Cristi, and the Río Yuna, flowing east toward Sánchez. The valley formed by these two river systems extends from Manzanillo Bay near the Haitian border eastward across the Republic to Samaná Bay. It is about 145 miles long and varies in width from 10 to 30 miles. On the north is the Cordillera Setentrional and on the south the irregular Cordillera Central, which is indented by the valleys of the many tributaries of the Yaque del Norte and the Yuna.

The Cibao is divided into two distinct physiographical and climatic regions, the eastern and the western, by a watershed near the city of Santiago. Santiago is the most important city in the Valley, and the capital



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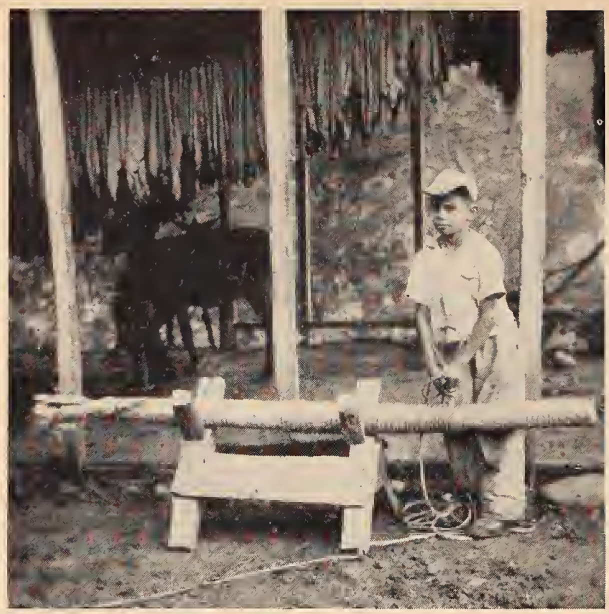

Andullo, or plug tobacco, which is made by compressing tobacco leaves in a tightly drawn rope coil of *cabulla* sisal, is one of the interesting agricultural products of the Cibao Valley. Note tobacco leaves hanging in shed.

of the Province of Santiago. It is the second-largest city in the country, with a population of nearly 50,000. Situated on a bluff overlooking the Río Yaque del Norte, the present city is the third Santiago, the two previous towns having been destroyed by earthquakes, first in 1564 and later in 1842.

Although the Cibao is located between the 19° and 20° parallels North, the average temperature varies from 65° in February to 90° F. in August. The Dominican Republic lies in the belt of the northeast trade winds. In the Cibao they blow mostly from the east and bring the rainfall and modify the summer heat in the eastern part.

Irrigation Farming In Western Cibao

Because of irregular rainfall, irrigation is widely used for farming in the western Cibao lowlands. Natural vegetation is drought-resistant and includes mesquite and all sizes of cacti. Cattle grazing on the pasturelands suffer during a continued dry spell. Numerous goats are found in this section.

Consideration is being given to the construction of reservoirs to provide storage from the regular flow of the Yaque del Norte River against periods of scanty rainfall. Private canals have been supplemented by government projects, until a series of canals stretch from Santiago to Monte Cristi. When these are completed, about 75,000 acres will be under irrigation.

Approximately one-half of Dominican rice is produced on the lands which are watered from the Río Yaque del Norte. It is this production under irrigation which enables the Dominican Republic to produce a surplus for export to neighboring islands. Rice cultivation has increased greatly during the last 10 years. Oxen are used for plowing, and the rice is harvested mostly by hand.

Plantains, bananas, and various other products are also grown by means of irrigation. A large fruit company is cultivating bananas in the Yaque delta, using an overhead irrigation system. The soil must be washed and drained to reduce its salinity.

Transitional Zone Important Producing Area

Several food crops, including corn and *yuca* (cassava), are grown in the central part of the Valley, in the transitional zone between the western and the eastern Cibao. *Yuca* is not only consumed as food, it is also the source of tapioca starch. An American company has a large factory near Santiago which makes a starch from both sweet and bitter *yuca*.

Tobacco is the most important cash crop. West of Santiago, tobacco suffers considerably during periods of drought, but between Santiago and Moca, the principal tobacco section, hundreds of *ranchos*, or tobacco-curing sheds, with palm-thatched roofs dot the horizon. Cultivation of this plant extends beyond the lowlands into the hills.

Certain tobacco growers make a plug tobacco known as *andullo*. Properly cured *tabaco de olor* is wrapped in the *yagua* (sheath) of the Royal palm and compressed by a tightly drawn rope of *cabulla* sisal into a roll about 3 inches in diameter and 8 to 10 feet in length, weighing from 18 to 25 pounds. The rope is removed after a few days, but the palm covering remains until a slice of the tobacco roll is cut off for use. *Andullo* has a strongly sweet odor, although its makers vow that no sweetening agents such as molasses are added to the tobacco.

Eastern Cibao

In the eastern Cibao there is a plain, rising from flat to gently rolling, called Vega Real, or Royal Meadow, which, with its deep, fertile, friable, grayish-black soil, is the most intensively cultivated and densely populated part of the entire country. Here the Royal palm and tropical vegetation stand out just

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as the xerophytic, or desert plants, are characteristic of the western Cibao. The Royal palm provides building material and food for both human beings and animals.

Cacao, the principal product, is grown on both small and large plantations. Cacao plantations in eastern Cibao are among the best in the world. As cacao must be shaded, the young trees are planted among plantains and bananas. When the cacao trees become established, however, no crops are cultivated among them, and the leguminous *amapola* (*Erythrina poeppigiana*) tree is used as shade principally. In some plantations coffee and cacao trees are mixed, but most of the coffee is grown at higher elevations in the mountains. Cacao is marketed through the port of Sánchez, located near the mouth of the Yuna River on Samaná Bay, and it takes the name "Sánchez cacao" after this port.

In addition to cacao, a considerable area is cultivated in plantains, bananas, nonirrigated rice, corn, *yuca*, and beans. Two, or even three, crops such as corn and rice are often grown in the same field in alternate rows. Citrus and tropical fruits grow semiwild.

Because rainfall is more plentiful in the eastern part than it is in the western, the River Yuna does not play as important a part as the Yaque del Norte does. Near the mouth of the Yuna the land is swampy and the soil is not fertile. Between the Vega Real and Samaná Bay, much of the land is planted with either guinea or *páez* grasses, and many cattle feed on extensive pastures.

The only railroad in the Dominican Republic which serves the public is in the Cibao. The narrow-gage *Ferrocarriles Unidos Dominicanos*, running from Moca to Sánchez, with branch lines to La Vega and San Francisco de Macorís, has carried much of the cargo that has moved through the port of Sánchez. Another line runs from Moca via Santiago to Puerto Plata on the northern coast. With the completion of a highway from Santiago to Puerto Plata, and the last sections of a motor road between the Vega Real and Sánchez under construction, the railroads are not as important as formerly. Now trucks can transport the products of the Cibao to the coastal towns.

Heavy tropical vegetation of the Vega Real. Sweet potatoes grow in the foreground. Directly back of the potatoes are a line of plantains, and in back of these is a cacao plantation.

As a traveler leaves the Cibao, he is well aware that he has been in the fruit and vegetable basket of the Dominican Republic, an important source of food not only for the country itself but for the Caribbean area. It is no wonder that the local people call it *la tierra de María Santísima*—heavenly land.

Rice production in the Dominican Republic has increased considerably during the last 10 years. Approximately one-half of all Dominican rice is produced on land watered by the Río Yaque del Norte.

BANANAS IN THE TROPICS

(*Continued from page 64*)

large as those of the Gros Michel. The compact bunches are made up of about 200 bananas. Although the fruit is of good quality, it is difficult to ship without bruising in spite of its comparatively thick skin. For long-distance transportation the hands must usually be separated from the stem and packed carefully in soft material.

Owing to the dwarf characteristics and hardiness of the plant, it is preferable to the Gros Michel for growing in windy places such as on mountain sides of tropical islands. In subtropical gardens extending from Florida to California the Cavendish banana is often grown as an ornamental plant.

Plantain: The third species, and the one which yields the largest fruit of the banana family, is *Musa paradisiaca*. The name, meaning fruit of paradise, is derived from a legend that "the tree flourished in the Garden of Eden, where its fruit was the source of the knowledge of good and evil."

The fruit of this species is commonly called the plantain, or cooking banana. It deserves to have precedence over any other member of the banana family because for centuries it has fed hundreds of thousands of people in many countries. At the door of almost every home in tropical America is a "patch" of plantains, valuable to the owner as a source of starchy food frequently a substitute for potatoes and bread. The ripe salmon-colored pulp, with cheesy, gummy texture and slightly acid taste, is not palatable for people when raw, but when boiled, fried, or baked it becomes a wholesome addition to any meal.

A bunch of plantains contains from 25 to 150 fingers 7 to 12 or more inches long. Because of the loose and spreading characteristic of the hands, plantains are difficult to ship. Like the Cavendish and Claret bananas the plantain is hardier and more disease resistant than the Gros Michel.

There are several varieties of true plantain, the difference being mostly in the shape, size, and color of the fruit, and the number and arrangement of hands. The Congo plantains of tropical America are usually characterized by larger bunches and smaller, plumpish fruits. Congo Verde is the most common variety. Congo Morado has fruit that is dull maroon when immature but changes to dark green as it ripens, whereas Congo Prieto produces a dark purplish fruit. The Enano, or dwarf plantain, is considered the smallest of the species. Its glossy yellow fruit is crowded on a long stem which contains 200 to 250 or more fingers. Perhaps the most handsome plantain is the Cuaranteno. The upper surface of its young leaves are blotched with chocolate or purple, the midrib and under-surface are tinged with maroon, and the young fingers are a dark purple.

Banana Trade Outlook

Although the plantain undoubtedly will remain one of the basic food crops of the American tropics, the Gros Michel can be expected to continue its role as the king of bananas for export. Cultivation of Gros Michel on tens of thousands of acres in the Americas represents more than half a billion dollars investment of United States and native capital. Of nearly 90,000,000 bunches of bananas exported annually before the war from Mexico, Central America, the West Indies, and South America, at least 90 percent were Gros Michel. The United States took, roughly, 55,000,000 of the total amount.

Preference for the Gros Michel among United States consumers is likely to continue, because of its familiar appearance, flavor, and uses. The Claret variety will no doubt receive continued acceptance especially around Christmas time because of its unusual color. Air transportation, permitting the rapid transit of delicate, perishable varieties such as the Lady Finger, may provide the link for introducing some of the more exotic varieties to North American consumers.

Cavendish variety of bananas growing in Cuba. Although averaging only 5 to 7 feet in height, these trees produce huge bunches of bananas. Cavendish ranks second in commercial importance.

ALONG THE *Agricultural Front*

▲ Chile To Develop Beet Sugar Industry

Through the development of a beet sugar industry Chile is planning to produce enough raw sugar to meet its needs. Trial plantings of sugar beets are being carried on in various parts of the country where investigations have shown that farming conditions are favorable. Plans call for eventual construction of 10 sugar refineries at a total cost of approximately $20,000,000. It is expected that a small experimental beet-sugar mill will be in operation by next year, and a full-size refinery by 1949.

▲ Mexico Plans Assistance for Owners of Livestock

Legislation has been submitted to the Mexican Chamber of Deputies which will permit Mexico's Bank of Agricultural Credit, a semi-governmental institution, to lend money to owners of private livestock holdings on a long-term basis. Under the legislation the bank would also be given the power to establish a system of agricultural and livestock insurance in cooperation with agencies of the Mexican Government, and agricultural and livestock associations. Reasons for the proposed legislation are a desire to develop large pasture areas in Mexico suitable for livestock production, and a need for more animal products to meet domestic demand.

▲ Importation of Used Jute Bags For Exporting Coffee

Importation into Guatemala of used bags, forbidden since 1923, is now allowed under the terms of a governmental resolution. The measure has been taken to alleviate the shortage of bags, particularly jute bags, used primarily for the exportation of coffee from Guatemala.

PAN AMERICAN DAY APRIL 14

"Cooperation—Keynote of the Americas" is the theme for Pan American Day in 1947. This is the seventeenth observance of a day set aside by the Governments of the American Republics to emphasize anew the bonds of friendship which unite the nations of the Western Hemisphere. During the entire week of April 13–19, throughout the republics of North, Middle, and South America, festivities are planned, including a luncheon by U. S. Secretary of Agriculture Clinton P. Anderson for Latin American trainees and dignitaries.

Teachers and group leaders may secure material and suggestions for programs and displays from the Pan American Union, Washington 6, D. C.

▲ Cuban Henequen Production Increases

Cuban production of henequen fiber has shown a steady increase during the last few years. Production for 1946 was more than 31,000,000 pounds, which was a considerable increase over that of the year previous. Indications are that production for this year will be even greater. Although the United States normally provides a good demand for Cuban henequen, recently the Cuban cordage industry has absorbed the entire domestic production of the fiber.

▲ Chile's Sunflower-Seed Acreage Shows Expansion

Chile's oil-bearing sunflower-seed acreage for the present season is reported to be more than half again as large as for the year before, and nearly twice as large as the 5-year average. First official estimates have placed the 1946–47 figure at more than 50,000 acres.

▲ Home Demonstration Week Scheduled for May 4 to 11

The second annual Home Demonstration Week will be observed from May 4 to 11 throughout the United States, Alaska, Hawaii, and Puerto Rico. "Today's Home Builds Tomorrow's World" is the theme. Active partners in events of the week will be some 3½ million rural women, and extension workers of the 51 land-grant colleges and of the Department of Agriculture.

Home demonstration work is a far-reaching education program for women. They continue to study ways and means of forwarding their family's health, comfort, and happiness, by providing proper food and nutrition, buying wisely both food and clothing, beautifying their homes, and simplifying housework. From better homes their interest extends to better communities and on to the people of the world.

▲ Mexican President Favors Colonization

President Miguel Aleman of Mexico is interested in the colonization of new land in the coastal and irrigable regions of his country. Not long after his inauguration he proposed the establishment of a national commission to carry out such a program. In his inaugural address President Aleman said that if new land is made available for colonization, "all Mexicans so desiring" may be helped by their Government to increase Mexico's farm production and "thus build on the land the foundations of a great Republic."

CORRECTION

It has been brought to the attention of the editor by a member of the medical profession that a statement on page 206 of the December issue of *Agriculture in the Americas* is incorrect. The statement reads: "Another advantage of goat milk over cow milk is that it does not need to be boiled before being used, as goats are hardy and do not easily catch communicable diseases." Officials of the U. S. Department of Agriculture agree with the medical doctor that this statement is incorrect.

Reading about the AMERICAS

The Ancient Maya, by Sylvanus G. Morley. 520 pp., illus. Stanford University Press, Stanford University, Calif., 1946. Dr. Morley, after 40 years of study of the Maya civilization, which flourished in pre-Columbian times in northern Central America and southern Mexico, has summarized the complete story of these ancient people. He traces their history from its "shadowy beginnings in the third or second millenium B. C.," through the Maya Old Empire (A. D. 317–987), the Maya New Empire (987–1542), until after the Spanish Conquest (A. D. 1542–1697). The importance of maize, or Indian corn, in their civilization is emphasized. Their achievements in astronomy, mathematics, and chronology grew out of the necessity of calculating and recording the passing seasons, the farmer's year, and the true length of the solar year, in the cultivation of this crop, which was a great experiment in agriculture. Also, the corn-gods and the associated rain-gods, wind-gods, and sun-gods which determined the fate of the growing corn formed the heart of the Mayan worship. A classified bibliography, many illustrations, and a specially designed colored jacket depicting the "ancient Maya gods of rain and fertility fructifying the growing corn" add to the value and attractiveness of the volume.

Cuba, by Erna Fergusson. 250 pp., illus. Alfred A. Knopf, New York, N. Y., 1946. Here is a fund of information about Cuba, gained through many months spent on the Island. The author visited not only Havana, but the interior as well; not only "sophisticated Cuba," with its Yacht Club, Country Club, Lyceum, Lawn Tennis Club, and its *La Sociedad Pro-Arte Musical*, but also the abandoned mining towns, Havana's underworld, and the "lovely quietude" of the Isle of Pines, which has suffered frequently from hurricanes sweeping the Caribbean. One chapter, "The Price of Sugar," beginning "A sugar plantation is a lovely sight," tells the story of Cuba's sugar industry and its relation to the United States sugar supply. Under the titles "The Colonial Complex," "The Revolutionary Tradition," and "Intervening Uncle," the history of Cuba is given, including the real story of the famous message to García.

Elements of Soil Conservation, by Hugh Hammond Bennett. 406 pp., illus. McGraw-Hill Book Company, Inc., 1947. In this new text is found a comprehensive presentation of the problems of soil erosion and soil exhaustion, and tested methods of solving these problems through modern soil conservation techniques. It contains a vast amount of up-to-date technical information and data in language that is easy to understand. The book is profusely illustrated, and at the end of each chapter is a list of references and of questions for classroom discussion. A helpful feature is a list of visual aids—motion pictures and film strips—to illustrate the material in the book, including the sources from which they may be secured.

Our Neighbors of the Andes, by F. D. David. 92 pp., illus. Catholic Foreign Mission Society of America, Field Afar Press, New York, N. Y., 1947. The author tells the story, from Pre-Incan days to modern times, of the three Andean countries—"storied Peru", "sky-high and jungle-low Bolivia", and "Ecuador, land of equatorial snows"—bringing in the part which the Church played in that history.

Science, by D. W. Hill. 114 pp. Chemical Publishing Co., Inc., Brooklyn, N. Y., 1946. Under such headings as "Science and Industry," "Science and War," "Science and Education," the author tries to show that the aim of science is to assist and not to destroy mankind. In showing that agriculture, transportation, and all phases of our life are aided by science, he uses the cotton industry as an illustration

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Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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U. S. GOVERNMENT PRINTING OFFICE: 1947

Gifts of the Americas

PAPAYA

by MARY S. COINER

One of many delicious tropical fruits not widely consumed in the United States is the papaya (*Carica papaya*). This fruit is native to tropical America, though the exact area of its origin has not been determined. Some botanists assert that the species originated in the West Indies or in Central America near the Gulf of Mexico; others believe it came originally from Mexico.

The papaya spread rapidly during the seventeenth and eighteenth centuries. As early as 1598 it was reported to have been carried from the West Indies to Malacca and India. It is believed to have spread by seed through the South Pacific islands and apparently was introduced into Hawaii between 1800 and 1823 by an early Spanish settler.

At present papaya is cultivated in most of the tropical countries of the world and as far north as 32° latitude. In the United States it is grown chiefly in Florida, and in a limited way in frost-free areas of Texas and California.

In English-speaking countries the papaya is commonly called pawpaw or papaw, though the use of this term tends to confuse *C. papaya* with another unrelated species. The English name papaya is said to be a corruption of the Caribbean *ababai.* In Cuba the fruit is known as *fruta bomba.*

There are few fruit trees that grow as rapidly or yield as heavily as the papaya. Actually the papaya is an herbaceous plant having a single stem 15 to 25 feet in height and surmounted by a cluster of large leaves. The fruit is borne near the top of the trunk, usually from 10 to 30 on each plant. Production of fruit from seedling plants requires 10 to 14 months from germination of the seed to ripening of the first fruit. Flowering and fruiting are continuous so that at any time flowers and ripe fruits may be present on one plant. The life of papaya plants is comparatively short, 3 or 4 years at the most.

Papayas vary in appearance according to variety. Generally, they are pear-shaped, with a center cavity containing small black seeds. The flesh, similar in texture to that of a honeydew melon, is sweet and thick, ranging in color from bright yellow to deep salmon pink. The Solo variety, a favorite in the Tropics, produces an abundance of pear-shaped fruits averaging 16 ounces in weight. The ripe fruit is bright yellow and has a fresh sweet taste. Blue Stem, popular in Florida, has oblong fruits weighing 4 to 8 pounds. The skin is rough, the color dark green, yellowing slightly toward maturity. The flesh is thick and meaty, with fine flavor and golden color.

In the Tropics the papaya is an important article of diet, much esteemed as a breakfast or dessert fruit. It is eaten like cantaloupe, either plain or with a little salt, lemon or lime juice. Many years ago people of the West Indies tenderized meat by placing it between papaya leaves. A traveler in tropical America noted that sometimes people would gorge themselves with fresh or spoiled meat, because they had no way of keeping it. They always finished off the meal with a generous portion of papaya. Their survival after such gluttony was ascribed to eating the papaya, which aided in digesting their meal.

The digestive property of the papaya is due to an enzyme called papain which abounds in the green fruit and also in the leaves. Latex containing papain is obtained by lacerating the fruit with bone or bamboo knives. The juice is caught in glass or porcelain containers because contact with metal darkens it and reduces its value. The coagulated latex is dried as rapidly as possible in a kiln or in the sun until it separates into a creamy-white powder.

The most essential use of papain in the United States is in preparations for the relief of digestive ills. Its most extensive use is in preparations for tenderizing tough meats.* In 1945 the United States imported 315,000 pounds of papain, 74 percent of which came from British East Africa.

Several commercial products are made from papayas. A canning company in Florida puts out a fruit salad cold-packed in glass, consisting of ripe papaya, pear, orange, peach, and grapefruit. Papaya marmalade is a tasty product utilizing fruits too soft for shipping. Canned papaya juice is seen in our groceries.

Papayas, both fresh and canned, rank high as a source of vitamins A and C. Since the "sunshine" vitamin D is usually found wherever A occurs, there is reason to believe that papayas are a rich source of this vitamin also. Papayas should be a welcome addition to any meal not only because of their wealth of vitamins but because of their color and taste appeal.

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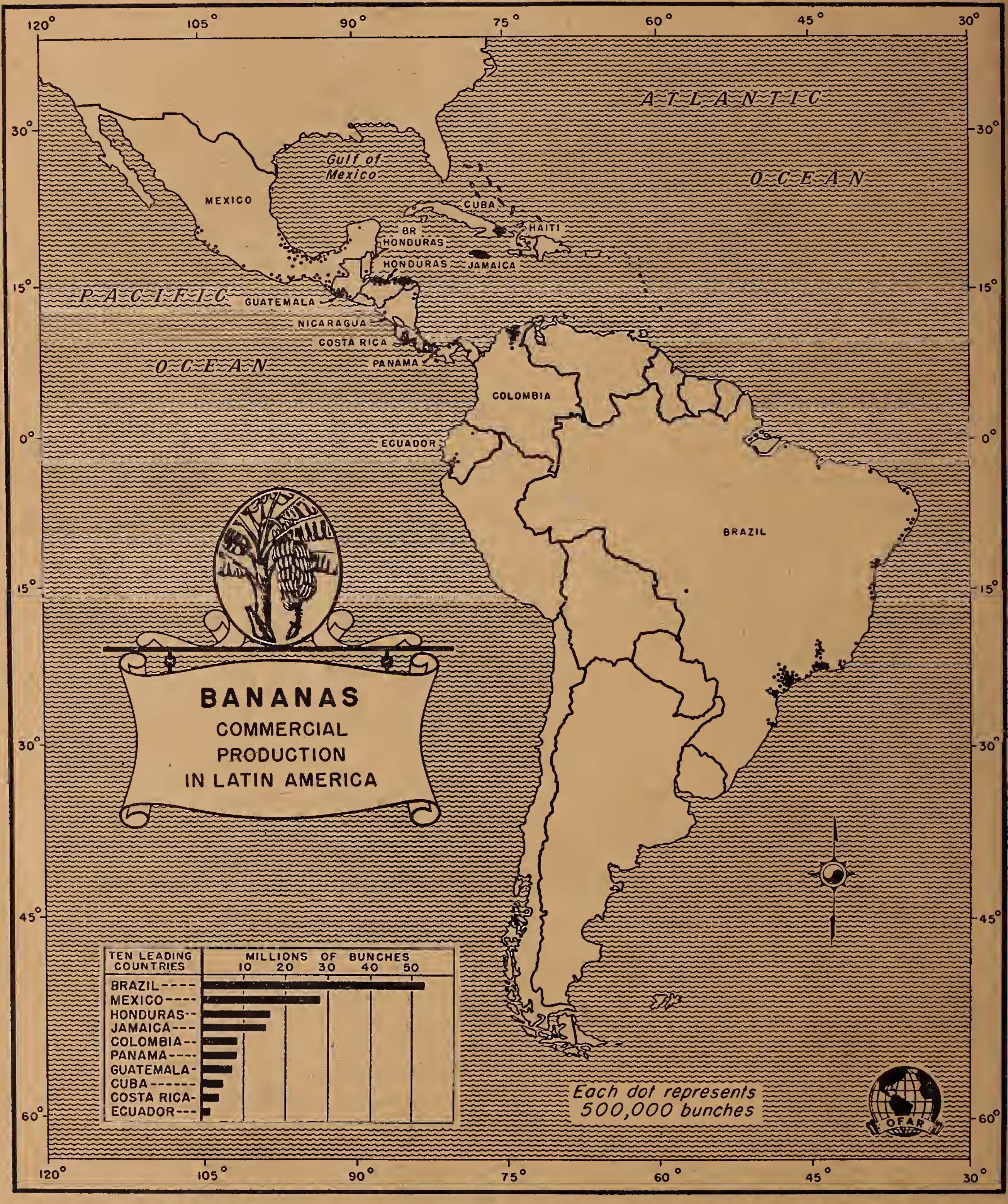
* *See* "To Make Tough Meat Tender" by Rogers McVaugh in the July 1943 issue of *Agriculture in the Americas.*



BANANAS
COMMERCIAL PRODUCTION
IN LATIN AMERICA

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Agriculture IN THE Americas

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June-July 1947

NAMES & NEWS

Rafael Flores B.
Returns to Guatemala

Rafael Flores B., Secretary-Treasurer of the *Instituto Agropecuario Nacional,* Guatemala City, Guatemala, who has spent a year in the United States as a trainee with the Office of Foreign Agricultural Relations, is now on a travel-study tour en route to Guatemala. Sr. Flores B. came to this country under the sponsorship of the Guatemalan Government to study agricultural research, administration of laboratories, and experiment stations.

●

John W. Johnston, Jr.
Assigned to Guatemala

John W. Johnston, Jr., has been assigned as Agronomist on the staff of the Cooperative Agricultural Experiment Station, Guatemala City, Guatemala. Before his service in the U. S. N. R., he served as Agriculture Specialist, Food Supply Division, C. I. A. A. in Recife, Brazil. Mr. and Mrs. Johnston were expected to arrive in Guatemala late in March.

●

Laurenz Greene
Assigned to El Salvador

Dr. Laurenz Greene has gone to El Salvador to serve as Horticulturist at the Cooperative Agricultural Experiment Station in that country. Dr. Greene has had many years of experience as experimentalist in Iowa State College and Iowa Experiment Station and as Chief in Horticulture and Head of the Department of Horticulture at Purdue University, School of Agriculture.

●

Virgil C. Pettit
In South and Central America

Virgil C. Pettit, Agricultural Engineer, OFAR, has been detailed temporarily to Peru, El Salvador, Guatemala, and Nicaragua. He will serve as Consultant on planning and construction of the physical plant at the Cooperative Agricultural Experiment Stations in these countries, as well as on related agricultural engineering and machinery problems.

●

Gahan and Raun
Inspect Malaria
Control in Mexico

In 1945 *James Bonnet Gahan,* in cooperation with the International Health Division of the Rockefeller Foundation and the Mexican Ministry of Health, conducted extensive tests of the residual effects of DDT in the control of *Anopheles* mosquitoes and malaria in malarious areas of Mexico. Accompanied by *Earle Spangler Raun,* Mr. Gahan has returned to Mexico for the spring months to observe results of the previous work and to repeat the applications of DDT if necessary.

●

John Forres O'Donnal
Returns to Guatemala

John Forres O'Donnal returned to Guatemala early this year, after a period of leave spent in the United States. Mr. O'Donnal has been in charge of the Cooperative Rubber Program of the U. S. Department of Agriculture in Guatemala since 1942 and during the past 2 years has supervised the establishment of a field station for the propagation and distribution of planting material throughout that Republic.

●

Allen H. Nicol
In El Salvador

Allen H. Nicol is in El Salvador to study, under the direction of the Director of the Cooperative Agricultural Experiment Station, the geological and seismological phases of the Laguna Zapotitán area drainage and reclamation project. Mr. Nicol, who is a geologist in the U. S. Geological Survey, has been detailed to the Office of Foreign Agricultural Relations by the Department of Interior for 3 months in order to make this study.

Agriculture IN THE *Americas*

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San Martin Province and The Tingo María Station

In the Huallaga Valley of eastern Peru the Tingo María Cooperative Agricultural Experiment Station is the gateway to two areas which have possibilities of development. The writer tells of a trip made into one of these hinterlands.

by EILIF V. MILLER

Stretching east and north of Tingo María in the foothills of the Andes Mountains of eastern Peru are two hinterlands. The inclusion of these areas in the Station's intensified program of extension work for the people already living there and the opening of the territory for new settlers must of necessity depend largely upon development of means of transportation and a study of the tropical crops for which the land is best adapted.

Already the Central Highway, recently completed from Lima to Tingo María and on to Pucallpa, is opening up the eastern hinterland. Along this highway are scattered farms, and large plantations devoted to the growing of rubber, tea, cube, cinchona, and coca have been established through governmental aid.

Gateway to San Martin

From Tingo María, which is the point at which the Central Highway turns eastward, a great river, the turbulent Huallaga, flows northward. This river

An early morning fog over the jungle and upper reaches of the Huallaga River.

San Martineños, who have long known the art of raft making, use this means of transportation to carry themselves and their cargoes to the villages along the Huallaga River and to the deep-water Amazon-tributary port of Iquitos.

leads to the other almost forgotten hinterland, the Province of San Martin, which could be served directly by the experiment station.

The little village of Tingo María is already serving as a gateway to this province. Here, trucks and the smaller *camionetas* arrive on the Highway from Lima and discharge their loads of merchandise, food, and bottled drinks. The people alighting from the trucks speak with a drawl, wholly new to the person who knows only the *Castellano* language of the cities. They are from the Province of San Martin and are on their way home from Lima, bringing their supplies by truck as far as Tingo María.

At Tingo María they will construct balsa rafts to carry themselves and their cargoes to the villages along the river. San Martineños have long known the lore of rafting, for almost their entire produce floats on rafts down the Huallaga from Bellavista, Juanjui, and the other river ports to be sold in the deep-water Amazon-tributary port of Iquitos. Around Tingo María the *topo*, or balsa, trees (*Ochroma* sp.) are becoming scarce, but the people who "know" penetrate into the Tulumayo Valley and bring out the thin light logs for sale at the equivalent of $1.50 each. The logs are bound together with rope vines provided by nature, and the top parts of the rafts are spiked into the *topos* with sharp hardwood stakes. The upper deck, called *barbacoa*, is a floor of canes of the 30-foot river grass *caña brava* (*Gynerium* sp.). It rides above the reach of all but the most vicious river waves. Here the cargoes are lashed in place, and sometimes a leafy roof is curved over the *barbacoa* to shed rains and the rays of the bright Huallaga sun.

Journey Down the Huallaga on a Raft

As the traveler descends the river on one of these light rafts, for days he passes virgin jungle. Then there are the patches of clearings at Uchiza, where coca (*Erythroxylon coca*) is the main crop. Again the jungle is almost solid as far as Tocache, where a few farmers specialize in cube (*Lonchocarpus* sp.), an insecticide crop. The forests are rich in fine timbers, but no one can get them out to market. During the boom, rubber was gathered all along this humid stretch of the upper Huallaga from Tingo María to Tocache and Pazana.

Here the river enters the limestone canyons. Smoothly, silently the rafts glide along between the straight-wall canyon cliffs. Then they plunge through foaming rapids where the current emerges from the containing walls. This is dangerous water, and many a raft has come to an untimely end in the *muyunas* (whirlpools) of Sion and the boiling waves of the Cayumba rapids.

Every night in the valley of the rainy upper Huallaga we shivered in the cold Andean air waves rolling down from the west. Each morning a low gray fog hovered over us as we awoke on the balsa raft. Almost every morning there were ducks flying along the channel at exactly 6:30.

The shores of river-wash soil were thick with enormous cane grass, *caña brava*, and *chicosa*, its lesser fan-shaped relative. The Cordilleras of the Andes were visible each time the river bends took us westward for a few minutes.

All this was our experience until we reached the farm called Jesus del Monte, after leaving behind the canyons of Sion and the rapids of Cayumba. When we arrived one evening, it was getting late, and the farm did not seem so different from the valley at Tocache. We made our fire, ate, and went to sleep.

Next morning it was plain that we had left the jungle behind. We awoke to a morning as balmy as the night before. No fog hung over us, and the sun rose early. As I walked up into the forest behind Jesus del Monte, I realized that the different feel in the air was something permanent, a part of the climate. The shrubby "bush" of drought-resistant species took me by surprise. To me Jesus del Monte will always seem the boundary of San Martin, even though the political line was crossed many days before in the forest between Tingo María and Uchiza.

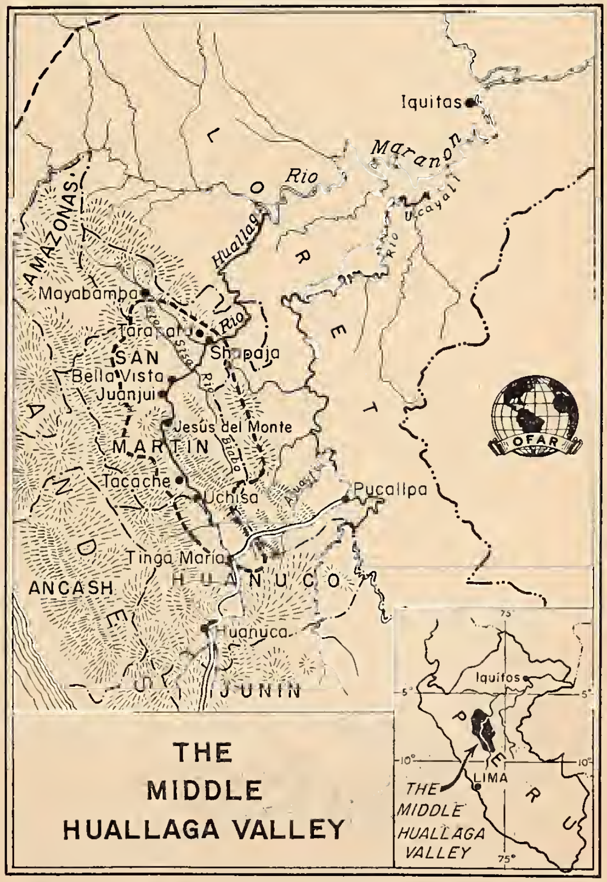
From this point onward through Huayabamba, Juanjui, Bellavista, and Shapaja open vegetation of hardwoods makes up the virgin forest. Trees of setico (Cecropia), guayaba (*Psidium pomifium*), cordoncillo (*Piper* spp.), atadijo, shimbillo (*Inga* spp.), shapaja palms, and topo occupy the re-growth of former clearings and are called *purma* vegetation.

Land Use In San Martin

In San Martin the pastures of *grama* (Bermuda grass) dry up brown during the season of June through September, but this resistant variety emerges luxuriantly when the next season's rains fall. In all of the old settled San Martin dry forest belt the Bermuda grass pastures on the river banks and hillsides are planted with a scattering of stately shapaja palms, whose fruits are a useful feed for hogs. Guinea grass pastures are excellent on all soil types.

A steady traffic of hog and cattle rafts goes down river to Iquitos. As is usual where only a single market exists the seller is at a disadvantage, and there is frequently some grumbling on the river banks before the sales are transacted.

The main cultivated crops of lower San Martin are corn and beans. These are seeded in February.



U S DEPARTMENT OF AGRICULTURE — OFFICE OF FOREIGN AGRICULTURAL RELATIONS

Eilif V. Miller is an Agriculturist (Soils Technology), Office of Foreign Agricultural Relations. He spent 3 years at the cooperative agricultural station in Ecuador.

There is a season of good rains from January to April, which puts even the stiffest clays into favorable tilth for crops. No plowing is done in this forest region; almost all agricultural operations are made with the machete. *Yuca* (*Manihot esculenta*) is widely grown for food, and the friable, more sandy soil types are sought for this crop.

Some hilltop soils, 1,000 feet above the Huallaga river level, have a steadier status of soil moisture than the lowlands, are more acid, and of a softer consistence. For these reasons there is a tendency for riverbank farmers to maintain upland farms, where they cultivate root crops like cube and *yuca* while the lower slopes and benches have been dedicated to corn and cotton. Coffee and corn are grown on the dark red soils of the hilly uplands, and cotton is the specialty on valley benches where soils are heavy black calcareous clay.

Along the river on well-watered river silt some farmers raise sugarcane, chiefly for alcohol production. On the limited area of river bottoms corn, beans, and bananas are the preferred crops. A famous tobacco is grown near Tarapoto, and coconuts are highly productive in and around the towns.

Perhaps the most interesting product of San Martin is a rare medicinal substance which comes from forests in the valley of Río Sisa just below Bellavista. It is a sirupy concentrate called curare, extracted from the vine which the Indians call *lampi huasca*. Curare is proving of much value in the medical world through its unique anaesthetic properties.

Balsa trees are of great importance because of their use in construction of the rafts so necessary for marketing all products down-river. They re-occupy the *purmas*, or cut-over lands along the river, and often the length of the crop rotation is fixed by the time required to produce raft-size logs.

Air view of the broad and turbulent Huallaga River, near the village of Juanjui.

Farmstead near Bellavista in lower San Martin.

Future of the People Of San Martin Province

By the time I had finished my trip on muleback from the river port of Shapaja to the town of coconut palms, Tarapoto, I was thoroughly convinced of the importance of the Province of San Martin and its robust inhabitants. Many thousands of people live in the Province. They are not among those who have been recently transplanted from the *Sierra* or from the coast to the *Montaña*. Rather, they are descendants of many generations of dwellers in this region. Scattered along the Huallaga Valley they have made their homesteads. They will still be there when Tingo María as a center of agricultural improvement is able to come through to them with its program of extension work. Through the years they have gained an equilibrium with their environment. In years to come they may, conceivably, form the basis of an expanding immigration into Amazonas or even the Pucallpa hinterland and become successful farmers there as well as in their own valley.

When planners for Peruvian development build their next jungle highway, they will do well to consider the rich Huallaga Valley and the solid inhabitants of San Martin. At present the return journey from Tarapoto to Tingo María must be made by air, flying over miles of *purmas*, the meanders of the Río Sisa, the broad valley of the Río Biabo, the cluster of cube farms at Tocache, and the wilds of Aucayacu. A highway into San Martin would open up a chance to extend to that Province the agricultural benefits of the Tingo María Experiment Station.

Cuban Avocados Take to the Air

Avocados from Habana to Miami in about an hour! That is what modern airplane transportation is accomplishing for Cuban fruit growers and for avocado-hungry people in the United States in the off-season before the California and Florida crops are ready.

by PHILIP M. DAVENPORT

During the summer of 1946 Cuba made its first large commercial shipments of perishable cargo by air to the United States. About 1,000,000 pounds of avocados moved in Douglas DC-3's on a 1-hour Habana-Miami shuttle schedule. The Cuban Ministry of Agriculture and the Air Transport Commission have cooperated with avocado shippers to permit commercial aircraft to land at Habana and pick up avocado shipments.

Even though the cost of shipping by air to Miami and thence in refrigerated railroad cars to the New York market is considerably greater than that of sea shipments direct to New York, the decreased loss from spoilage means a larger net return to the shipper. At the same time the use of cardboard containers holding from 8 to 15 pounds of fruit, rather than the heavier 55-pound wooden crates used in shipping by sea, is expected to popularize the avocado among independent grocers who ordinarily cannot easily dispose of a large crate before spoilage occurs.

Avocados Long Known And Popular in Cuba

Like corn, potatoes, and tobacco, the avocado is a native of the Americas. Early explorers found the Indians in the Antilles, Central America, and Mexico eating the yellowish, oily pulp of an unfamiliar fruit with a green or purple skin. These Spanish settlers, like people today, were probably slow to appreciate its delicate, nutty flavor, but they finally came to enjoy the fruit and christened it *aguacate*, a derivative of the Aztec *ahuacatl*. The English name avocado and its corruption, alligator pear, come from the Spanish word.

Once the popularity of the avocado was established among the colonizers of Cuba, it was accepted as an important part of the Island diet. Today Cuba is reputed to have a larger per capita consumption of avocados than any other country in the world. The trees require little or no care, and every palm-thatched *bohío* may have one or more large avocado trees nearby, providing shade from the hot sun and a large supply of fine fruit from June until late fall.

Many Varieties In Habana Markets

A great variety of locally produced avocados is offered for sale in Habana markets. Sizes range from small fruit of not more than 3 or 4 ounces to giants of over 3 pounds. Shapes are also numerous. Some avocados are perfectly round; many are pear-shaped; and still others resemble an overgrown carrot in shape. Similarly, the colors of ripe avocados run through various hues of green, maroon, and purple. Flavors also vary—sweetish, nutty, or cream-like.

Botanically speaking, Cuban avocados, of which more than 50 recognized varieties are said to grow on

Like corn, potatoes, and tobacco, the avocado is a native of the Americas. Early explorers found the Indians in the Antilles, Central America, and Mexico eating the yellowish oily flesh, which is so popular today in North American markets.

the Island, are largely of the original West Indian strain. Some mixture with Mexican and Guatemalan types has, however, taken place. Among the most commonly seen varieties are: Raúl Arango, Pollack, Trapp, Catalina, Cajel, Acosta, Santana, Simmons, Hernández, and Mantequilla.

A census conducted by the Cuban Government in 1928 and 1929 placed the number of avocado trees on the Island at over 500,000. This figure probably fails to include a large part of the dooryard trees or of groves in remote areas.

Although avocados are produced throughout the Island, Habana Province is the center of production. The million inhabitants of the Habana metropolitan area eagerly purchase the fruit, whether sold at corner fruit stands or in the city's large markets.

A number of well-tended avocado orchards are located in the agricultural section south of Habana. The rich, well-drained soil of this region is almost ideal for the growth of the trees. Grafted stock of recognized varieties is employed so that the fruit will be uniform. Trees are pruned and fertilizer is used to maintain yields.

Numerous clusters of avocado trees on smaller farms also furnish commercial fruit. These trees frequently grow to a much larger size than those in the orchards, although they get little care. Many of them obtain a height of 50 or 60 feet, and they bear prolifically. Sale of surplus avocados beyond the needs of his family affords the farmer welcome supplementary income.

Proper State of Maturity Important in Harvesting

The proper state of maturity for picking depends upon the time required for the fruit to reach the market. Avocados ripen well in transit, but the best flavor is obtained if they are left on the trees as long as possible. The new rapid transit by air allows the fruit for United States markets to remain on the tree longer and reach a later stage of ripeness than when a slower journey by ship is to be made. Thus a more attractive and valuable fruit becomes available to consumers.

Avocados packed in flats and ready for shipment by air.

A great variety of locally grown avocados is offered for sale in the markets of Habana. These are known as Catalina avocados.

When the avocados are to be harvested, men go through the groves cutting fruit from the higher branches with knives tied to the ends of long poles. The fruit falls into a bag attached near the top of the pole, thus avoiding bruises. Gathering the fruit from the taller trees growing more or less without cultivation frequently requires that the picker climb high into the branches. He tosses the fruit to a man on the ground, who catches it in a cloth net.

Avocados are usually hauled from the farm by ox-cart or truck. Those destined for domestic sale are conveyed directly to the Habana wholesale produce market, where they are sorted and passed on to retailers. Those intended for export are hauled to one of several small packing houses near Habana and graded by size and variety, under the supervision of a representative of the Cuban Ministry of Agriculture's Export Inspection Service.

If they are to be shipped by air, the inspected avocados are crated and carried by truck directly from the packing house to Rancho Boyeros Airport, a few miles from Habana. Airport workers move the

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Mr. Davenport is Second Secretary of the American Embassy, at Habana, Cuba.

crates to the planes in small hand trucks and load them with extreme care to prevent damage to the fruit. A crate of 55 pounds net weight is employed for shipments by boat, and the same container is used to some extent for air shipments, but the smaller flats, which are relatively lighter, cheaper, and more readily available, are more popular for air shipments.

Avocados Rank Third Among Cuban Export Fruits

During the last 30 years, the growing popularity of the fruit among people in the United States who had never even seen an avocado tree served to promote Cuba's exports at the same time that it encouraged development of domestic production in California and Florida. In fact, avocados have replaced grapefruit as Cuba's third-most-important export fruit, being exceeded only by bananas and pineapples.

United States importation of Cuban avocados has been facilitated by the provision of the United States-Cuban Commercial Convention of 1902, which bound on the free list those Cuban articles which were imported free of duty in 1902. These provisions were carried over into the Reciprocal Trade Agreement of 1934. To safeguard the position of California and Florida fruit growers, however, the Cuban Government in 1934 agreed to ship avocados to the United States only between June and September, inclusive. Most of Cuba's shipments are made during July and August when few California or Florida avocados are ready for market.

Wartime shipping shortages forced Cuban exporters to curtail sharply the packing of avocados for United States markets. Small boats were able to carry to Florida ports nearly 3 million pounds of avocados in 1943 and 1944, but in 1945 exports of the fruit dropped to a little over 200,000 pounds, as a direct result of the hurricane of October 1944 and the severe drought during the winter and spring of 1945. Production in 1946 was much larger, though still not quite reaching the normal prewar level.

Airplanes Are Important Transportation Medium

About one-fifth of Cuba's total shipments last year were transported by air. The planes made over 150 round trips, carrying an average of 6,000 pounds net of fruit on a trip. At present, operation of the larger DC-4's is in prospect. Once these are put into service, fruit can be moved directly by air to relatively distant markets, such as New Orleans and New York.

Even if shippers decide against carrying the bulk of Cuba's avocado exports by air in the 1947 season in view of the fact that shipping service may be improved, it still may be worth while to ship high-quality fruit by air in order to take advantage of the full premium obtainable in the United States markets for tree-ripened avocados. Current air shipments of the fruit will give both shippers and carriers valuable experience in the rapid marketing of a perishable product and will serve as a guide to the feasibility of large-scale air movement of other items highly subject to spoilage.

Bananas have been grown for centuries in many tropical areas, but large scale trade did not take place until the twentieth century. The United States is the world's largest importer, usually taking more than half of the tonnage moving in the international trade.

When avocados are to be harvested, they are cut from the higher branches with knives tied to the ends of long poles. The fruit falls into a bag attached near the top of the pole, thus avoiding bruises.

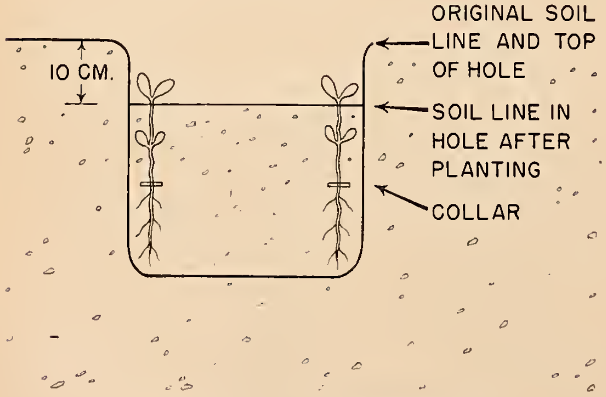
The Hole Planting System Of the Upper Amazon Valley

by CHARLES F. SWINGLE *and* BOWEN S. CRANDALL

The vast region of the Upper Amazon Valley, extending from Colombia to Bolivia throughout the territory of high rainfall and including elevations roughly of 1,000 to 8,000 feet, has a comparatively meager native population and what appears to be a relatively crude system of agriculture. At lower elevations along the Amazon, Indians have developed crude methods of raising short-period crops during the dry—that is, the non-flood—periods and have a few tree crops, including banana and peach palm (*Guilielma* spp.). Also, during the past few years many small infiltrations of colonists have pushed into this area from agricultural regions to the west.

The *Estación Experimental Agrícola de Tingo María*, operated jointly by the U. S. Department of Agriculture and the Peruvian Ministry of Agriculture, is located in the Amazon basin of Peru. It was established in 1942 for the express purpose of helping in the process of learning to farm most wisely in this tropical area of steep slopes and 100 to 150 inches of rainfall.

One of the first hindrances to successful agriculture encountered in this region was the strange way almost all colonists planted their crops. It seems all the more peculiar when one realizes that these farmers, who came from agricultural regions to the west, did not bring this system of planting with them. In the highlands, where more than half the population of Peru lives, potatoes, corn, quinoa, wheat, squash, and vegetable crops are grown in sufficient quantities to support a large part of Peru's population. On the coast, by means of irrigation are grown most tropical and subtropical crops which can be produced in a rainless climate. But in neither of these parts is the *hueco* system used.

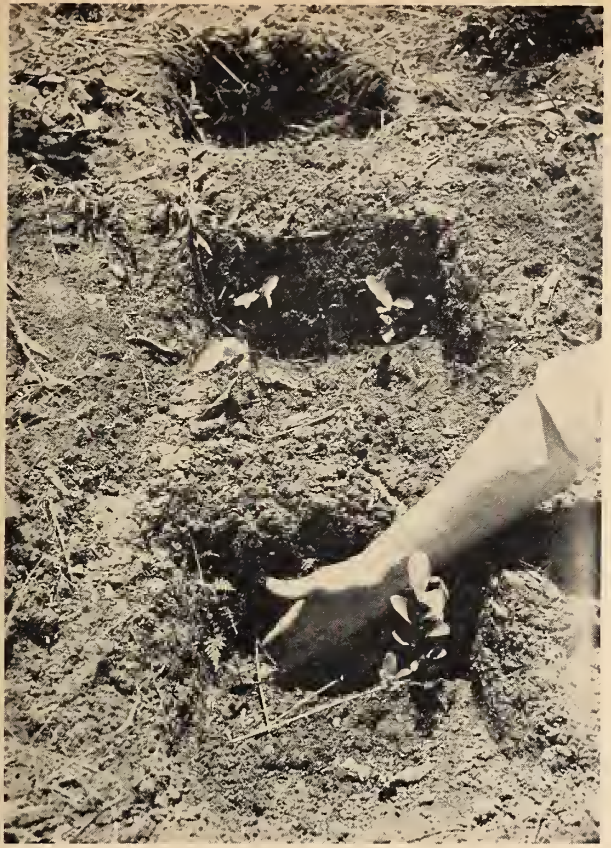

ORIGINAL SOIL LINE AND TOP OF HOLE
10 CM.
SOIL LINE IN HOLE AFTER PLANTING
COLLAR

Cross section of typical *hueco* planting.

The *hueco* system of planting (*hueco* is Spanish for hole) is used for practically all crops grown in this region—coca (*Erythroxylon coca*), cube (*Lonchocarpus utilis*), quinine (Cinchona spp.), tea (*Thea sinensis*), coffee, oranges, maize, and manioc (*Manihot esculenta*). With maize the seeds, and with manioc and cube the unrooted stem cuttings, are handled as are seedlings of the other crops.

Under this system, young plants are subjected to excessive moisture. For trees, holes are dug from about 8 to 16 inches across and 12 to 20 inches deep, several days or even weeks before planting. With some species, "in order to get a good strong plant," from 2 to 6 plants are put into each hole. These are planted with the collar several inches below the top of the hole. The hole accumulates water with the first rain and is always wetter than the surrounding land, until the hole has collected enough soil to fill it. Frequently more of the plant's top is below ground than above. Occasionally in the planting process the top soil is placed around the roots, but usually no distinction is made between top soil and that dug from the bottom of the hole. If, as commonly happens, the interval between digging the hole and planting is dry, the plants may have a lot of dry soil placed around their roots. Usually no fertilizer of any sort is used.

Mr. Swingle is Agriculturist (Horticulture), and Mr. Crandall is Agriculturist (Plant Pathology), Office of Foreign Agricultural Relations, U. S. Department of Agriculture. They are stationed at *Estación Experimental Agrícola de Tingo María,* Peru, where investigations in connection with the *hueco* system of planting are in progress.



Under the *hueco* system of planting, holes from 12 to 20 inches deep are dug several days or even weeks before planting time. The young plants are placed with the collar several inches below the top of the hole. Water and soil then slowly accumulate in the hole. This illustration shows coca plants 3 months after planting.

Problems Arise From the System

Under such circumstances, naturally, losses are high and many calls for help in combatting plant diseases are received by the station. It is impossible to estimate the effect of this method of planting in relation to attack on above-ground portions of weakened plants by diseases and insects. Problems developing in the root system are more apparent and easier to trace back to the original source.

These disease problems range from those which can be considered of purely physiological origin due entirely to the drowning of roots and burial of stem tissue; through those where the action of normally saprophitic or weakly parasitic fungi is so aided by the unfavorable environment that they are able to attack and kill their hosts; to those types where because of *hueco* planting the host plants are attacked by parasites which they might escape if they were given every advantage of favorable site and planting techniques.

Interestingly enough, the first two cases investigated were both *Cinchona officinalis* L. One in the Mapiri region of Bolivia,* in a 4,000,000-tree plantation development using planting stock of local origin, involved the most extreme *hueco* system thus far seen. The trees declined and died about the fourth year, from the combined effects of drowning of root and compression in the impermeable-clay hole. No evidence of the action of primary parasites was observed. The other case involved Ledger type *C. officinalis* L. in the Tingo María region of Peru. These trees differed from their original parent stock only in the long history of migration from Bolivia to Java to Formosa and, finally, some 70 years later, back to Peru. In this case, however, epidemic losses occurred, and investigation disclosed the *hueco* system of planting was predisposing the trees to attack by a root- and collar-rot parasite of the genus *Phytophthora*. Investigations still continuing indicate that losses from this parasite may be reduced to a minimum by proper planting on well drained sites.

In between these two extremes are found tea and cube failing to develop roots because of drowning and

Losses are high from plant diseases under the *hueco* system of planting. Considerable experimentation is being carried on at the Tingo María Cooperative Agricultural Experiment Station to combat these diseases.

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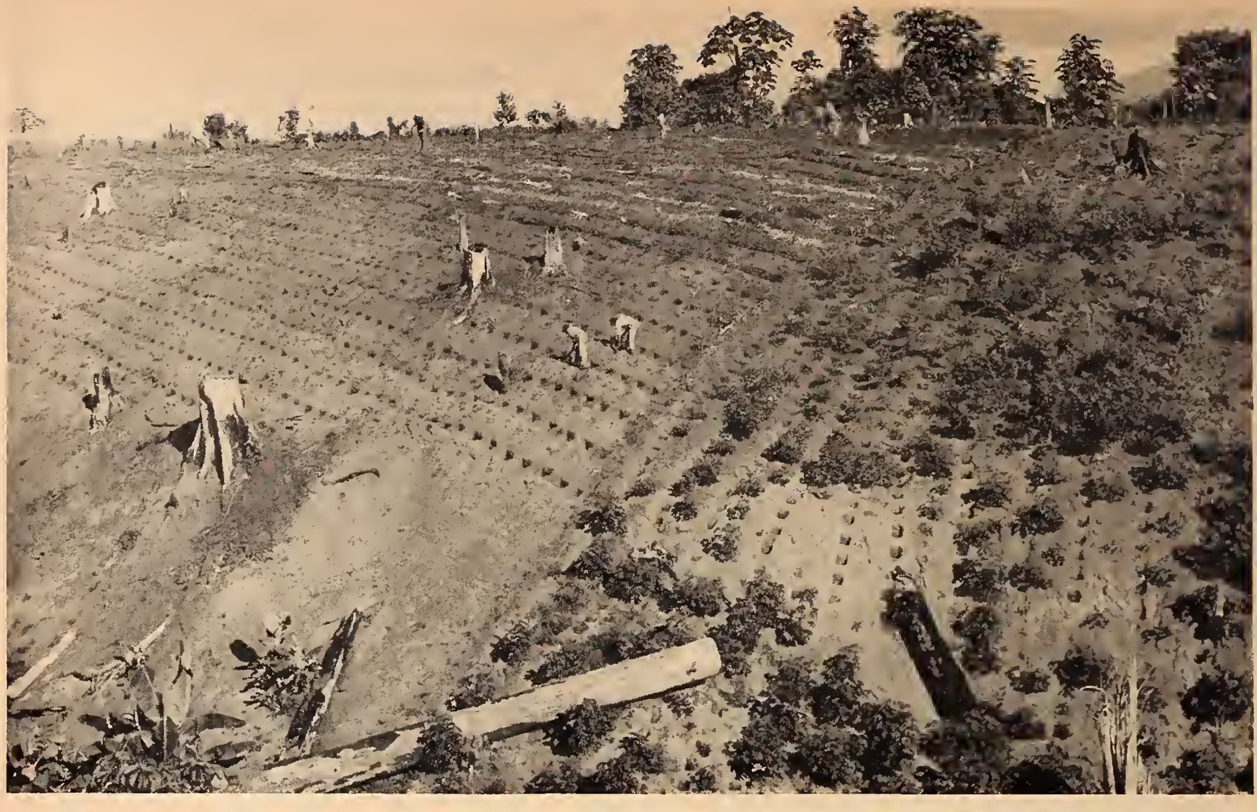
* *See* "In Quest of Quinine" by C. L. Horn in the July 1944 issue of *Agriculture in the Americas.*



A field being prepared under the *hueco* system for planting coca near Tingo María, Peru. Tea, coffee, avocado, coca, cinchona, and other crops are planted in this manner.

bacterial action. On slightly older plants of tea and coca which have survived in spite of the deep planting, weakly parasitic fungi such as *Armellaria* sp. cause the plant to die when they parasitize the stem tissue which in the process of cultivation is covered with soil. This same effect of the covering of susceptible stem tissue during cultivation has brought into prominence losses from gummosis, caused by *Phytophthora parasitica* Dast, on sweet oranges budded on sour orange gummosis-resistant stocks. All the work involved in producing this resistant combination comes to nothing when the orange is planted so deeply that the susceptible sweet orange stem is placed in contact with the soil. In fact, it has been observed that such damage is much greater than with old ungrafted orange seedling trees.

Avocados, both budded and seedling varieties, are subject to attack throughout this region by *Phytophthora cinnamomi* Rands when *hueco* planting has created conditions favorable to this species of fungus. It causes a serious root and collar disease whenever the tree is grown on any but the best-drained sites.

The specific cases cited are of common enough occurrence to be recognized as individual disease problems. In addition, almost every variety of tree or shrub planted in the region has at one time or another been found in trouble as a result of the *hueco* technique.

Origin of System Not Known

Local farmers, when asked to explain why they use this sytem of planting, give more or less uniform answers: They have always used it for coca and manioc; labor is accustomed to it; therefore it is continued for tree crops. Or, the slightly more logical answer is sometimes given that soils are too wet for much planting during the wet season, and during the dry season this system is used to guarantee sufficient moisture for the initial growth. The practice may be a carry-over of a semi-arid environment in which deep planting was necessary to insure sufficient moisture for germination.

The reason advanced for use of the *hueco* system in planting Bolivian cinchona is somewhat more logical, though equally faulty. There the method is said to serve a dual purpose. Disregarding the fact that cinchona normally makes its root growth just below

(*Continued on page 95*)

Slobolt Lettuce for the Tropics

Fresh lettuce in the daily diet is considered a "must" by many people. A new variety which will not bolt in warm temperatures—that is, produce seed prematurely—is a great contribution to tropical agriculture.

by NORMAN F. CHILDERS
and PEDRO SEGUINOT ROBLES

Leaf lettuce is one of the vegetables commonly grown in the Tropics. It is probably more popular than head lettuce because under most tropical conditions the temperature is not sufficiently cool to induce good solid heading. The standard leaf lettuce used in Puerto Rico is Black Seeded Simpson, which under proper management grows well during the cool months of the year, but during the warm summer months is impractical because of its tendency to bolt and rapidly form flower stalks.

Heavy rains, excessive soil moisture, and leaf spot disease during the summer period at Mayaguez, Puerto Rico, are factors to be considered in choosing a lettuce variety. There is need for a lettuce of the nonheading type which will not bolt during the summer months and which is relatively resistant to leaf spot.

New Slobolt Variety Meets Need in the Tropics

The new Slobolt variety of leaf lettuce developed at the U. S. Department of Agriculture Research Center, Beltsville, Maryland, has proved definitely satisfactory under Mayaguez conditions in both winter and summer. Slobolt is the result of 10 years of breeding and selection and comes from a cross between Grand Rapids leaf lettuce and a small butterhead variety of extremely slow-bolting tendency obtained from France.

Slobolt has been tested extensively during the warm months and in the warm regions of the United States and has proved of particular value in home and small-market gardens. Large quantities of this variety were grown by gardeners of the U. S. Armed Forces in tropical regions during the latter years of World War II. In fact, Slobolt was the leading and, in some cases, sole variety grown by the hydroponics method in the camps on the Varien Ascension Islands off the West Coast of Africa, in British Guiana, and in the Caribbean area.

This variety has a yellowish-green curly type leaf of medium-to-large size. At Mayaguez the bunches may attain a diameter of 20 inches during the cool months of November to March. During the summer period, however, Slobolt forms a smaller bunch about the size of the winter-grown Black Seeded Simpson. It can be developed in a period of about 75 to 90 days for market sales, depending upon growing conditions.

For home-garden use the bunches may be pulled when small, or only the lower leaves removed from the bunch when they have attained sufficient size and maturity, leaving the upper leaves to develop further. Under the latter system leaves can be harvested once or twice a week from the lower 6 or 8 inches of the stalk before the entire top is eventually harvested. Obviously, only a variety of slow-bolting tendency

Slobolt is proving a satisfactory variety of leaf lettuce for Puerto Rico. During the cool months of November to March, bunches may attain a diameter of 20 inches.

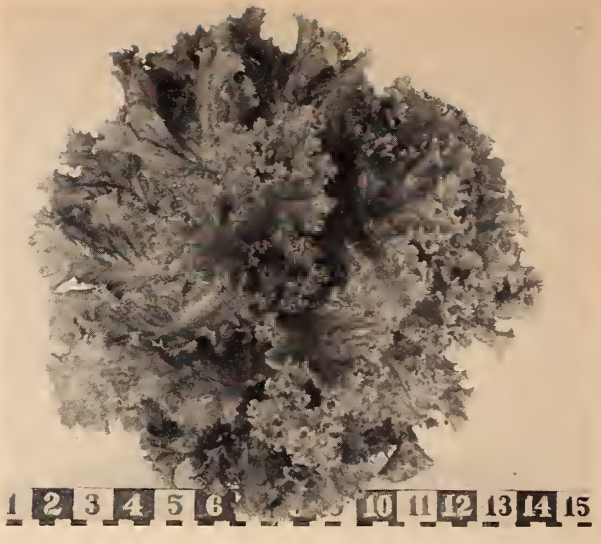
could supply this quantity of leaves without sending up a flower stalk.

Raising Slobolt Is Not Difficult

A brief review of the climatic conditions under which this variety of lettuce is growing at Mayaguez and in other sections of Puerto Rico is of interest for comparison with other tropical regions where the growing of Slobolt may be desirable. The rainy season normally begins in May and extends through October. In some months, such as August and September, rainfall may reach 10 to 13 inches, whereas during the dry season in January and February, rainfall may be as low as ½ to 1 inch. Irrigation is necessary during the dry months. The mean temperature during 1945, which is typical, was a little over 79° in August and 74° F. in January. At the two sub-stations of the Federal Experiment Station located at Maricao and Toro Negro at altitudes of about 2,000 and 3,000 feet, respectively, the temperature the year round is approximately 5° lower than at sea level. Lettuce and most other vegetables grow better at the higher altitudes in Puerto Rico.

Leaf lettuce is a relatively easy vegetable to grow. Usual procedure at Mayaguez is to use level beds in the dry season because they do not dry out so quickly, and raised beds in the rainy season to alleviate excess soil moisture. If adequate irrigation is available and regularly applied, there is no reason why raised beds, which workers find more convenient for cultivation, cannot be used the year round. For the home garden the beds may be built 6 to 10 or more inches high and approximately 20 inches apart. A border of rocks or of boards held in place by stakes will prevent the soil from eroding and will stop encroachment of weeds and grass.

Irrigation is provided by shallow furrows between the rows. If beds are used, a 3- to 4-inch ridge of soil can be constructed as a dam around the outside, and the entire bed flooded. Irrigation by sprinklers is not particularly desirable with lettuce because the leaves become moistened and soil and disease spores are splashed on the leaves, making leaf spot and other diseases more of a problem. A fertile loose soil regularly supplied with moisture is of paramount importance in growing crisp high-quality lettuce.



In tropical summer heat, bunches of Slobolt are smaller than in winter, but this variety has the advantage of being extremely slow to bolt.

Before planting, the organic-matter content of the soil should be increased, thus improving its moisture-holding capacity and aeration. Soils in the Tropics tend to be relatively low in organic matter because of the higher mean temperature, which is inducive to rapid decomposition. Where available, it is unquestionably important that a 2- to 3-inch layer of well-rotted manure, leaf mold, or compost be added to the top of the bed and thoroughly worked into the upper few inches of soil. It is generally advisable, also, to use one or two applications of a commercial fertilizer such as 6–9–5 or 16–20 ammonium phosphate. About 2 or 3 weeks after transplanting lettuce seedlings a side dressing of one medium-size handful of ammonium sulfate, sodium nitrate, or 16–20 ammonium phosphate should be made to every 6 feet of row.*

There are two methods of starting Slobolt lettuce. One is to grow transplants in a flat, pot, or garden seedbed. Soil for flats or pots can be sterilized to free it from nematodes and damping-off disease by pouring a gallon of boiling water over each half gallon of soil; or, a flat of soil can be placed in the kitchen oven for 2 hours at 180° F.

In a garden seedbed the soil should be worked into a fine state of tilth and enriched. The seed may be sown in shallow furrows or broadcast over the surface and sprinkled lightly with fine soil. The soil should be kept moist but not wet by spreading a damp burlap sack over the bed until the seeds begin to germinate. To protect the seedbed from excessive sun and beating

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*Commercial practices for lettuce varieties such as Slobolt are discussed in detail in "Lettuce Varieties and Culture" by Ross C. Thompson, U. S. Department of Agriculture, Farmers Bulletin 1935, issued in 1944. Details of cultivation practices at Mayaguez may be secured by writing to the Federal Experiment Station, Mayaguez, Puerto Rico.

Black Seeded Simpson lettuce grows well during cool weather. In the heat of the tropical summer, however, it has a tendency to bolt.

rain, sheets of galvanized iron are frequently used mounted on a frame, 3 or 4 feet above the bed to allow sufficient light from the sides. About 5 days are usually required for the seed to germinate, and from 2 to 4 weeks before the plants are ready for transplanting.

An alternative method, preferred by many people, is to sow lettuce seed directly in the field beds in shallow furrows 12 to 15 inches apart. When the seedlings have three or four good-size leaves, they are thinned. Thinnings are used on the table, or transplanted to new rows to extend the harvesting season. If good-size bunches are to develop, plants must be thinned to about 15 inches apart. During the summer months leaves are harvested while young in order to avoid toughness and strong flavor. Strong flavor can be reduced further by shading with one or two layers of cheesecloth or screen wire.

Lettuce should be cultivated frequently. Mulches of lawn clippings, cane trash, or similar plant debris applied when the plants are 2 to 4 inches high are effective in maintaining an even soil moisture and in keeping down weeds. An extra application of a nitrogen-carrying fertilizer may be necessary when mulches are used, to avoid a nitrogen deficiency.

Norman G. Childers is Assistant Director of the Federal Experiment Station, U. S. Department of Agriculture, Mayaguez, Puerto Rico.

Pedro Seguinot Robles is Collaborating Agronomist, Government of Puerto Rico, at Mayaguez.

Little difficulty has been experienced at Mayaguez with diseases and insects on Slobolt lettuce. Diseases such as leaf spot, bacterial rot, or bottom rot are reduced or eliminated by avoiding the splashing of soil and water on the leaves, by wider spacing of the plants, and by rotating the beds. Aphids can be controlled by spraying thoroughly with a solution containing a teaspoonful of nicotine sulfate and a 1-inch cube of finely chipped soap in every gallon of spray. Aphids must be hit with the spray for thorough control. Cutworms, slugs, and snails occasionally damage young plants or cut them off at the ground level. Poison bait is effective when scattered lightly along the lettuce rows in late afternoon at about weekly intervals. Another control measure is to insert 4-inch-wide paper collars into the soil to a depth of one inch; or, collars can be made from old tin cans by removing the bottoms.

HOLE PLANTING SYSTEM

(*Continued from page 92*)

the humus layer, the theory has been evolved that deep planting gets the roots down into the good soil and, in addition, provides needed shade for the top of the plant during the first year. Indeed, the hole used is so deep that fern fronds can be placed across the top to shade the newly planted seedling.

What seems a better explanation is that the system has evolved as a result of the land-clearing method currently used. When a piece of virgin land is cleared, the timber is first felled, allowed to dry thoroughly, and then burned on the site. The rather thin humus layer is usually destroyed. In order to insure against a washing away of the seed by surface water, a deep hole is needed in the clay subsoil. Since most of the land in use is steeply sloping, it seems logical to assume that once in common usage the *hueco* system would not be varied for use on the small areas of bottom land which were opened up.

In both Peru and Bolivia there has been considerable colonization, especially by the Japanese. Since no one seems to know where this system originated, the possibility exists that it was brought by Japanese from some part of Asia characterized by extremely dry conditions and was put into practice here without regard for the high annual rainfall. Though the Japanese have utilized this method in their cinchona plantation work in Peru, we have been unable to learn of any such system in use in Asia from workers familiar with that continent. Do we have here a case of "spontaneous generation" of a unique system of agriculture?

Fight Against Foot-and-Mouth Disease in Mexico

by JOHN A. HOPKINS

The United States and Mexico are cooperating in a campaign to eradicate foot-and-mouth disease from Mexico. The principal initial steps have consisted in the establishment for this purpose of a joint agency, which is to be located in Mexico City, and the provision of funds to carry on the campaign until July 1, 1947.

In late March announcement was made of the appointment of Lic. Oscar Flores, Mexican Under Secretary of Animal Industry, as Director, and of Dr. M. S. Shahan, Bureau of Animal Industry of the United States Department of Agriculture, as codirector of the joint agency. An administrative board, which will determine operating policy and exercise general supervision over the campaign, consists of the following persons:

Mexico: Dr. José Figueroa, Member of the Mexican National Commission for the Eradication of Foot-and-Mouth Disease; Dr. Francisco Rubio Lozano, Ministry of Agriculture and Animal Industry; Sr. Ignacio de la Torre, Ministry of Agriculture and Animal Industry.

United States: N. E. Dodd, Under Secretary of Agriculture; Dr. B. T. Simms, Chief, Bureau of Animal Industry, Department of Agriculture; Don Stoops, Assistant Agricultural Attaché, Mexico City.

Mexican expenditures in combatting the disease from its outbreak until the end of the fiscal year are estimated at $9,350,000, and the United States Congress has appropriated $9,000,000 as our contribution.

According to reports, the disease broke out first on a ranch near Veracruz. The first cases occurred early in November 1946, but the disease was first believed to be vesicular stomatitis, which occurs rather frequently in that area. Suspicion was aroused, however, by its rapid spread, and the United States Department of Agriculture was informed on December 18, 1946. Two experienced veterinarians were immediately sent to Mexico to cooperate with Mexican veterinarians in diagnosing the disease. It was found, without question, to be foot-and-mouth disease.

The Mexican Government started a campaign to control the disease in late December. By this time it had spread into eight Mexican States, and cases were reported over an area extending some 150 miles north and south, and 300 miles east and west from Veracruz into the Valley of Mexico. Several regiments of the Mexican Army were pressed into service to maintain quarantine lines, and control measures were adopted in an effort to keep the disease within the zone already infected. In spite of these measures, however, it has continued to spread, and in late March was reported in areas as far separated as the State of Chiapas, which borders Guatemala, and the States of Zacatecas and Aguascalientes, 300 miles northwest of Mexico City.

Since late December, two formal meetings of the Mexican-United States Agricultural Commission and several informal meetings between the United States and Mexican authorities have been held in order to map out a campaign.

After earlier adopting recommendations for immediate and adequate scientific, technical, and financial cooperation between the two countries toward the control and eradication of the disease, the Mexican-United States Agricultural Commission met on March 6, 1947, and adopted recommendations for the establishment and operation of the joint agency previously mentioned. Authority for such cooperation on the part of the United States is contained in an Act of Congress approved by President Truman.

At a later meeting on March 15 more detailed plans were worked out, and it was agreed that the United States Government would provide a large number of scientific and technical workers, as well as equipment and materials for the use of the eradication campaign. The Mexican Government is to maintain quarantine lines, chiefly by use of units of the Mexican Army, and is also to provide veterinarians and labor. Indemnifications for cattle slaughtered will be covered chiefly from the United States contribution, while indemnities on hogs, sheep, and goats will be covered from the Mexican Government. As a point of paramount importance, an effort is to be made to keep the disease within the boundaries of the present infected area. To help accomplish this purpose, susceptible livestock are to be removed from a secondary, or buffer, zone surrounding it. In both zones, according to present plans, animals in infected and directly exposed herds are to be slaughtered and destroyed, while animals in unexposed herds are to be disposed of rapidly through normal marketing channels.

Dr. Hopkins is Secretary of the Mexican-U. S. Agricultural Commission, which negotiated the agreement between the two Governments to establish the joint foot-and-mouth disease campaign.

ALONG THE *Agricultural Front*

▲ Cracking Machine For Nutmegs Invented

In Grenada, British West Indies, which is the source of a large part of the world's supply of nutmegs, an electrically operated machine for cracking nutmegs has recently been constructed. It will crack a 200-pound bag of nuts in about a minute and a half without, apparently, injuring the nuts.

The machine is simple in operation. The uncracked nutmegs are dumped into a hopper large enough to hold several bagfuls. They flow by gravity through a small hole in the funnel-shaped bottom of the hopper onto a rapidly revolving wooden wheel, with 2-inch notches, like a circular saw. The wheel gives the nuts a sharp tap and hurls them against the side of the chute, where the shells usually come off. By a mechanism similar to the one used in the United States to clean blueberries, the nuts are carried on a tilted canvas endless belt, from which the nuts, being round, roll off into containers, and the shells are carried to discard piles. Odd nuts here and there from which the shells do not fall off are put through the cracker again.

This machine, which is patented locally, has been installed by the largest exporter in Grenada. It may soon displace the hand-cracking methods by which the nutmegs from an estimated 10,000 acres of the Island have for many years been prepared for market.

▲Brazilian Tobacco Production Increased

Brazil has made a substantial increase in the production of tobacco during the past few years. Estimates place last year's crop at about 240 million pounds, which was about one-fifth more than the country's average production just before World War II. Heavy foreign and domestic demand and favorable prices have been important factors responsible for the rise. Governmental and trade organizations in Brazil are fostering improved methods of cultivation, wider use of fertilizer, and more uniform grading and marketing.

▲Cotton Mill Erected In São Paulo Province

Buildings for one of the largest cotton mills in South America are reaching completion in Ribeirão Preto, in the Province of São Paulo. The mill will have a capacity of 80,000 spindles, with the carding and feeding machines. It will not only spin but is expected to provide installations for cotton looms to consume the greater part of the production of the spinning machinery. Production of 160,000 meters of cotton fabrics per day is planned, with an annual consumption of over 10,000 bales.

Ribeirão Preto was selected as the site for this undertaking because this city is in the center of one of the important cotton-growing areas of Brazil, and the country around has reached the stage where labor is becoming available among the wives and daughters from the surrounding farms as well as from the city itself, which has a population of about 80,000. Approximately 2,000 persons will be employed in the mill.

▲ Colombia Producing Powdered and Condensed Milk

Colombia has recently put into operation two enterprises, one at Bugalagrande and the other at Bogotá, which are expected to produce at least 2,500,000 pounds of dry milk and 700,000 pounds of condensed milk annually. This is equal to the estimated demand within the country, though unsweetened evaporated milk will still be imported, as there is no local production as yet of that product.

Prior to May 1946, when the new plant at Bugalagrande began operation, farmers in the Valle del Cauca area had concentrated on raising cattle for beef rather than for dairy purposes. Since the new outlet for milk has been opened up, deliveries have been rolling in, and a sufficient supply of milk now seems assured.

▲ Solvent Extraction Method For Cottonseed Oil Developed by USDA

A new method for solvent extraction of oil from cottonseed that also removes in the same operation the objectionable pigment material in the seed has been developed at the Bureau of Agricultural and Industrial Chemistry's Southern Regional Research Laboratory. Similar research is being carried out by several commercial firms.

The discovery is based on two facts: (1) Substantially all of the pigment in the kernel occurs in glands, the walls of which are not affected by many of the solvents ordinarily used in extracting oil from seeds. (2) These pigment glands are lighter—that is, have a lower specific gravity—than either the meal left after extraction or the mixture of oil and the solvent used.

When kernels of cottonseed are flaked and then agitated violently in the solvent, the pigment glands break away from the other tissues. The solvent is a mixture carefully adjusted so that its specific gravity is between that of the pigment glands and that of the meal. After agitation, the whole mixture is allowed to stand, and the meal sinks to the bottom, while the pigment glands float to the surface and can be skimmed away.

The advantages of this method over the former method of cooking and pressing the seed are that both the meal and the oil are left practically free of pigment; there is complete recovery of oil; the oil is purer; and the remaining meal, being depigmented, is lighter, unmodified by heat, and is likely to have wider use as a protein source in industry and to be more desirable as feed for chickens and swine.

Reading about the AMERICAS

In a Changing Brazil, by Elsie Noble Caldwell. 198 pp., illus. Richard R. Smith, New York, N. Y., 1946. Since 1911 many changes have taken place in Brazil. Closely associated with the country during these years, the author analyzes some of these changes in informal good-humored style. She gives a vivid picture of "the little things that make up so much of everyday existence"—clothes, food, the preparation of coffee. In a chapter titled "Natural Resources" the reader learns of the coffee, cacao, various tropical fruits, and cattle which furnish the wealth of large *fazendas* and small farms; of the *mandioca*, which is a staple food of Brazilians; and of the Federal Bureaus established to aid the farmer in developing those resources. Political, commercial, and international aspects are also discussed.

Escuelas Prácticas de Agricultura. 354 pp., illus. *Secretaría de Educación Pública, Depto. de Enseñanza Agrícola, Mexico, 1946.* This is a detailed and comprehensive description of Mexico's practical schools of agriculture—the history of the beginnings of the movement for such schools; the plan of studies for each year, in the different phases of agriculture; the regulations and activities; and a map of Mexico showing the location of schools which are actually functioning and those which are to be established. There are chapters also on the agricultural experiment colonies which have been established and on the means of publicizing agricultural material.

Pichilingue, A Study of Rural Life in Coastal Ecuador, by Olen E. Leonard. 35 pp., illus., processed. Foreign Agriculture Report No. 17, U. S. Department of Agriculture, Washington, D. C., 1947. This study was made on the Government hacienda Pichilingue, the Agricultural Experiment Station of Ecuador operated jointly by the Government of Ecuador and the Office of Foreign Agricultural Relations, U. S. Department of Agriculture. The immediate objective was "to present certain selected information regarding the rural life of coastal Ecuador in a way that would benefit agricultural technicians and other persons working in the area." The study is concerned with the population; relation of the people to the land; social institutions; social differentiation, stratification, and mobility; and levels of living.

Technological Audit of Selected Mexican Industries, With Industrial Research Recommendations. 204 pp., illus. Armour Research Foundation of Illinois Institute of Technology, Chicago, Ill., 1946. This is the report of a project carried on by the Armour Research Foundation, "a detailed study of four major groups of industries within the Mexican Republic, for the purpose of making specific suggestions and recommendations toward further sound national industrial development." The industries studied are: Solid fuels, including such miscellaneous materials as sugarcane bagasse and rice hulls; hides and leather; fibers; and forest products.

Geografía Económica de Colombia, Tomo VII–Tolima, by Gonzalo Paris Lozano. 449 pp., illus. Sección de Publicaciones de la Contraloría General de la República, Bogotá, 1946. In this economic geography of the Department of Tolima, Colombia, the following topics are used as section headings: Location and Description of the Country; The People; Towns and Roads; Administration; Agriculture and Animal Husbandry; Mining and Lumbering; Manufactures; Banking; Brief Monographs on the Different Counties.

Concise Chemical and Technical Dictionary, edited by H. Bennett. 1055 pp. Chemical Publishing Company, Inc., Brooklyn, N. Y., 1947. This is a dictionary, containing 50,000 definitions and formulae of chemical, physical, biological, pharmaceutical, botanical fields, of raw materials and finished products, for both professionals and laymen. A special feature is a compilation of trade names of synthetic resins, rubber, textiles, food, and various other products.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS — O. R. CARRINGTON, EDITOR

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Gifts of the Americas

THE CHERIMOYA

by EMILY BULMAN

Although comparatively unknown in most parts of this country, the cherimoya has been a favorite fruit in tropical and subtropical regions for hundreds of years. It is essentially a dessert fruit. Its flesh is creamy white, with numerous imbedded brown seeds about the size and shape of the common bean. Its flavor has been described by Hainke as a "masterpiece of nature," and by Mark Twain as "deliciousness itself." Some Colombians have still another description: "The cherimoya is like matrimony—you never know how it will be until you try it!"

Until recent years the cherimoya grew wild and received little attention. Even now, it is not cultivated to any great extent. However, experiments have shown that by selection, grafting, pruning, and application of fertilizer, production of fruit can be greatly increased. Hand-pollination is an important means of developing higher-yielding strains, as close observation has proved that few pollen-carrying insects are attracted to the small white flowers.

Most authorities agree that the cherimoya is indigenous to the Andean region of southern Ecuador and northern Peru. It was carried by the Spaniards to other parts of tropical America, especially Mexico, where it is now a common fruit in many of the highland regions. As a matter of fact, it has been growing in Mexico for so many years that some people claim it is a native of that country. The common name which it bears, even in Mexico, is of Quichua origin (*chiri*, meaning cold, and *muya*, meaning seed), and numerous vases modeled from cherimoya fruits have been dug up from prehistoric graves in Peru. Later it was introduced to the Hawaiian Islands, the Mediterranean region, Africa, and India. In recent years it has been grown successfully in southern California.

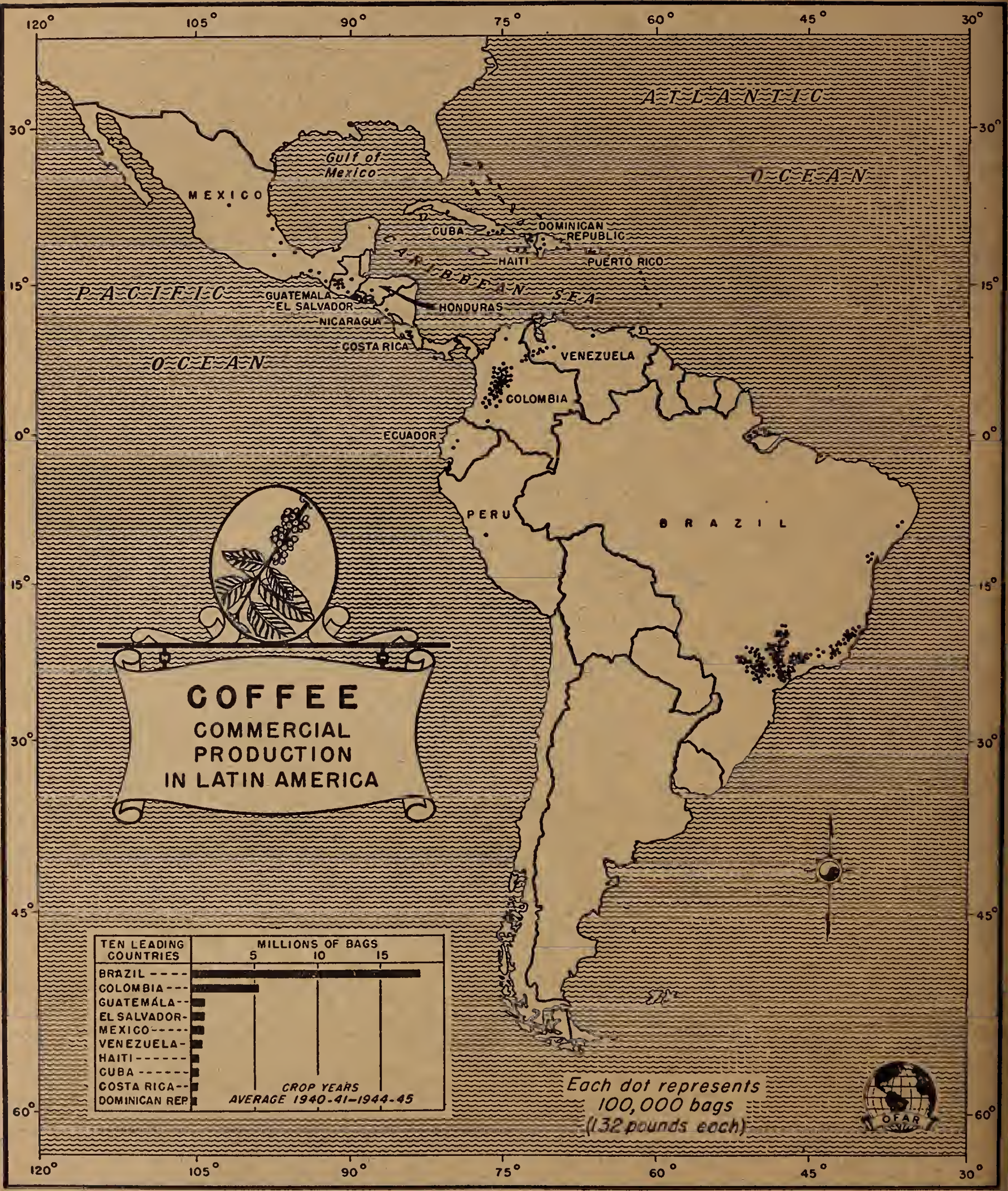
The true cherimoya (*Annona cherimola* Mill.) grows best in a cool and relatively dry climate, usually at an elevation of from 3,000 to 6,000 feet. The tree is rather small, erect, and spreading, rarely attaining a height of more than 25 feet. The fruit may be heart-shaped, conical, oval, or somewhat irregular in form, and in weight it ranges from a few ounces to 5 pounds. The surface of the fruit in some varieties is smooth; in others it is covered with wart-like protuberances. It is light green in color, and the skin is quite thin and delicate, necessitating careful handling of the fruit to avoid bruising.

There are two other important members of the cherimoya family that are commonly known in many tropical regions: the sugar apple (*Annona squamosa* L.) and the soursop (*Annona muricata* L.).

Unlike the cherimoya, which grows best at fairly high elevations, the sugar apple delights in a hot and relatively dry climate. It is rarely seen above elevations of 2,500 feet, since the plants cannot withstand cold weather. The fruit is generally round or heart-shaped, 2 to 3 inches in diameter, yellowish green in color, and covered with a thick white bloom. In 1672, P. Vincenzo Maria described it: "The pulp is very white, tender, delicate . . . and if presented to one unacquainted with it he would certainly take it for a blanc-mange."

Contrary to the requirements of the cherimoya or the sugar apple, the soursop succeeds best in a moist hot climate. However, it has been seen growing side by side with the sugar apple. Although the soursop, or *guanábana* as it is commonly called in Spanish-speaking countries, is quite widely disseminated, it is probably most popular in Cuba. The flesh is white, rather cottony in texture, and highly aromatic. The fresh fruit is sometimes eaten as a dessert, but those who have tasted it agree that for sherbet and refreshing drinks the soursop is unrivaled.

Although comparatively little has been done to improve the different varieties of the cherimoya, the experiments now in progress are likely to develop new varieties which can be shipped more easily. The fruit is tender and, at present, highly perishable. There is reason to believe, however, that with the establishment of quick-freezing plants close to the source of production, and air transportation of the fresh fruit, it will not be long before many more Temperate-Zone inhabitants can enjoy the cherimoya and other tropical fruits.



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August–September 1947

Dr. Alberto Lleras Installed as Director General of Pan American Union

At an impressive ceremony held in the Hall of the Americas on June 4, Dr. Alberto Lleras, distinguished author, journalist, and diplomat, and former President of Colombia, was installed as Director General of the Pan American Union. The ceremony was attended by the members of the Governing Board and the staff of the Pan American Union, and addresses were made by Antonio Rocha, Chairman of the Governing Board, and Pedro de Alba, Acting Director General, Pan American Union.

Succeeds Late Dr. L. S. Rowe

As Director of the Pan American Union Dr. Lleras succeeds the late Dr. L. S. Rowe, whose sudden and untimely death last December shocked the entire Western Hemisphere. During the 26 years that he served as Director General of the Pan American Union Dr. Rowe gained worldwide admiration and respect for his unwavering loyalty to the cause of Pan Americanism. As the trusted servant of 21 American Republics he was able, because of his tact, comprehension of international affairs, and outstanding ability, to consummate many important agreements and to insure the attainment of objectives that were for the best interests of the entire Hemisphere.

Dr. Lleras brings to the post of Director General a broad background of experience and achievement in international relations. A native of Colombia, he was born in Bogotá on July 3, 1906. He studied at the Ricaurte School, at the College of Our Lady of the Rosary, and at the School of Law and Political Sciences of that city. He early became interested in journalism and at various times has been associated with a number of South American publications. In 1929 he was sent to Europe by *El Mundo* (*The World*) as a special correspondent to cover the International Exposition at Seville.

In addition to journalism Dr. Lleras has been greatly interested in the field of political affairs, and his country has elected him to many important offices. From 1931 to 1933 he served in the Colombia House of Representatives. Other offices held by Dr. Lleras include Minister of the Interior, Minister of Foreign Affairs, Minister of National Education, Ambassador to the United States, and President of Colombia.

Dr. Rocha, in presenting Dr. Lleras at the installation ceremony, paid tribute to the new Director General as a Colombian statesman who "has had a broad administrative and political experience in all lines of human endeavor . . . ." He emphasized the fact that the Pan American Union is fortunate in having as its new Director General a man who served as Chief of the Colombian delegation to the Inter-American Conference on Problems of War and Peace at Chapultepec in 1945. Dr. Rocha said: "Many of you here took part in the discussions at the Mexico Conference, and many of you can bear witness how Dr. Lleras championed Pan American ideals and made them his, in mind and heart. He expressed these ideals in such a form that they could not only exist in harmony with the world organization, but also be directed toward a greater perfection of the System itself and thus achieve a higher degree of cooperation with the world organization.

"The concrete result of those deliberations was, among many other documents, the Act of Chapultepec, and many resolutions that are now being executed and implemented. This is an auspicious moment, then, in which Dr. Lleras assumes the directorship of the Pan American Union, because he brings with him the inter-American spirit that inspired these resolutions, and because he is a true witness to and a devout champion of those ideals. It is, therefore, extremely fortunate that just when the Inter-American System is to be implemented at approaching continental congresses, such as that at Bogotá, to which its complete and general reorganization is entrusted, Dr. Lleras as Director General of the Pan American Union is in a position to act with the same spirit of foresight and faith that he displayed in Mexico City. . . ."

Dr. Lleras Praises Work of Union

Dr. Lleras, in accepting his new office, praised the work of the Pan American Union and especially of his predecessor who, he declared, "for 26 years gave to this institution a prestige and a force which were only possible of achievement under one of his excellent qualities as organizer, diplomat and man of law, and that at a time when all was not as easy as it is today in the relations of the 21 American Republics."

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Beef Production in Guatemala

by GRAHAM S. QUATE

Production of beef has been an important part of Guatemala's agricultural economy for nearly 400 years, but the country has never exported meat to any great extent. It is now experiencing difficulty in meeting local demands. In spite of its long history and local importance the livestock industry has developed slowly. In recent times it has even lost ground.

During the period 1928–42 Guatemala suffered from a prolonged economic crisis which seriously affected the cattle business. Cattle prices reached unbelievably low levels and production declined. At the same time the population continued to expand rapidly and need for meat increased. Guatemala was at last obliged to begin the importation of feeder steers from neighboring Republics.

Until the beginning of the late war, and for a short time thereafter, thin light-weight range cattle from Honduras were available for as little as $12. Partially fattened low-priced steers were brought in from El Salvador. But now the days of cheap feeders and 10-cent beefsteaks are gone. Honduras and El Salvador are finding new markets for their surplus cattle, while Guatemala's purchasing power has risen and—consumption of beef has outstripped production.

Steers on the trail from Honduras to Guatemala.

Guatemala has fewer cattle in proportion to population than any other Central American country. The annual per capita consumption of beef is low, particularly for a country whose economy is essentially agricultural. Light beef consumption is somewhat offset by the fact that most rural inhabitants are reasonably well supplied with pork, eggs, poultry, and cheese. More beef is needed, however, especially for the workers who produce and distribute the great export crops, such as coffee, bananas, and cabinet woods.

Guatemalan Production Methods

Those concerned with the problem, including the producers themselves, recognize that, with a few exceptions, beef herds of Guatemala are of poor quality and that the industry is open to improvement. Native cattle of Guatemala, called *criolla*, are largely descended from animals imported by early Spanish colonists. Among these herds are many *criolla*-Brahman and other crosses, but in the past little has been done to improve breeds and production methods.

Local producers seldom cull undesirable cows from their herds, and in fact the killing of all cows is forbidden by law unless it can be proved that they are unable to bear calves. Often the breeding herds, as well as all calves and steers, are kept on the poorer pastures and range lands, the better feeding areas being reserved for fattening purposes. It is generally agreed that the small calf crops and the high mortality rate among young animals are due in large part to nutritional deficiencies.

All beef cattle in Guatemala are fattened on grass. Supplementary and concentrated feeds are used in relatively small quantities and only for dairy herds. Dry-lot feeding of beef cattle is never practiced. Steers are kept until 4 or 5 years old before being turned into the fattening pastures, and even at this advanced age many never weigh over 600 pounds. Imported steers weigh even less, and, because of their stunted condition, from 10 to 18 months are required for fattening. Steers ready for slaughter average around 800 pounds. Every slaughterhouse kill includes bulls, old cows, and worn-out oxen, which are sold as fresh beef, no canning or processing facilities being available.

Distribution of meat is on a strictly hand-to-mouth basis. Most beef is slaughtered during the night and offered for sale on the early morning markets the following day. Warehouse or refrigerated stocks of meat are nonexistent, and any temporary stoppage in the movement of animals from fattening pastures to slaughterhouse is immediately reflected in retail meat markets. Establishment of refrigerating facilities would be of great benefit to both producer and consumer.

Importation of new breeding stock was almost entirely neglected for many years, and even yet few ranches have systematic breeding programs. Beginning with 1936, breeding animals began arriving in greater numbers than before, but, even so, total importations during the period 1936–45 numbered no more than 110 head, and of these only 18 were registered stock. Heretofore there has been a tendency to purchase second-class nonregistered animals, probably because of the fear that high-bred expensive stock would succumb to local maladies upon transfer to the new environment.

Livestock producers have followed what seemed to be the most practical course in view of the low prices that have prevailed for a long time. They claim they are still hampered by the existing ceiling price of 6

With changing economic conditions and with the adoption of new attitudes by livestock producers, more and more attention is being given to the problems of development of specialized beef breeds adapted to the local environment. Among the breeds meeting with greatest favor are the Durham, Brown Swiss, Brahman, and Brahman-crosses such as Santa Gertrudis. On the left is a young Brahman-Criolla cow. On the right is a Brahman bull.

Increased livestock production in Guatemala must come from the coastal regions. Every available foot of highland, including the steepest mountain slopes, is utilized for cultivated crops.

Old workoxen are found in every herd of feeder cattle.

cents a pound (live weight) for fat cattle. But the increasing need for meat is creating a realization among all interested groups that many traditional practices must be replaced with modern methods for the breeding and care of cattle and for the production and distribution of beef. To do this, extensive investment must be made for development of improved pastures, for acquisition of equipment and materials needed on the ranches, and for purchase of new breeding stock. The Guatemalan Government recognizes these needs and is trying to develop national programs and policies which will promote progress in the beef-producing industry.

Pasture and Feeding Problems

In any tropical area the development and maintenance of pastures for cattle is an expensive process. Dense jungle growths must be removed, and second-growth brush must be cleared away two or three times a year. Some ranches are experimenting with rolling cutters drawn by oxen for the removal of brush and over-mature grasses. Better grasses are being sought, and more attention is being given to leguminous plants for improvement of pasture soils.

Some progressive producers are having success with irrigated pastures. Rains fall on the south-coast cattle country only from May through October. The remainder of the year is dry, and the shortage of forage becomes a serious problem in nonirrigated pastures. During the dry season cattle are turned into uncleared and densely wooded areas, where they manage to survive surprisingly well on leaves, dried-up vines, and a varied assortment of woody vegetation. At the beginning of the rainy period, when the semistarved cattle are taken from the woodland areas and placed on freshly sprouting grass pastures, they suffer by the sudden change of diet and are left in a condition from which they do not recover for weeks.

In Guatemala, cattle trading is usually done right out in the fields or even while the cattle are on the trail. Actual weights are seldom taken, and sometimes animals are judged by their height, a practice which leads to a preference for tall leggy animals. Another peculiar circumstance affecting breeding practices in the past has been the demand for work oxen with strong well-developed horns, a necessary characteristic where the Spanish-type yoke is used, since this is strapped directly to the horns of the animal.

Several factors are favorable for the establishment of mutually beneficial business relationships between North American breeders of beef cattle and Guatemalan producers. Guatemala has soils and a climate generally favorable to livestock production. The English language is commonly used in international trade, and Guatemalans are familiar with and like North American production methods. The intimacy of this relationship is shown by the fact that prominent livestock judges of the United States are called in each year to do the judging at Guatemala's traditional August Fair.

Shipment of purebred cattle to Guatemala from the United States is easily accomplished because of the generally overlooked close proximity of these two countries. Brownsville, Tex., is about midway as the crow flies between Guatemala City and Kansas City. Air-flight time from Guatemala to New Orleans is only 5 hours and 20 minutes. Freight planes with a carrying capacity of 20,000 pounds now deliver freight

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from the Southern States to Guatemala at rates approximating 10 cents per ton-mile. During November 1946, one Guatemalan rancher imported 1,000 ewe lambs from Texas by air freight. This shipment indicates the growing importance of air-freight facilities now available between the United States and Central America.

During the latter part of 1946 a number of Guatemalan livestock producers developed plans for the importation of high-class breeding stock from Texas by airplane. This part of their program met a serious setback in the appearance of foot-and-mouth disease in Mexico. The Government of Guatemala was prompt in recognizing the dangerous character of this epidemic and its effect on local beef production, should the disease spread southward. Strict quarantine measures were promptly applied against all animals from infected or threatened zones. Upon the adoption of a comprehensive program for stamping out the disease in Mexico with the assistance of the United States, a hope has arisen that foot-and-mouth disease may be kept out of Guatemala, and new plans for imports of breeding cattle are again under way.

Programs for Improved Methods

With changing economic conditions and with the adoption of new attitudes by livestock producers, more and more attention is being given to the problem of developing specialized beef breeds adapted to the local environment. Breeds meeting with greatest favor among beef producers are the Durham, Brown Swiss, Brahman, and Brahman-crosses such as Santa Gertrudis.

Meat as a prime food necessity has necessarily been subject to governmental regulation during this period of change. Prices have been controlled and exportations restricted for the benefit of consumers. Also, governmental services have been expanded in an effort to assist the producers.

Cattlemen favor crosses that will produce types suitable for use as draft animals.

The Instituto Agropecuario Nacional, a research division of the Ministry of Agriculture, has given livestock improvement a high place in its program. The *Instituto* receives technical assistance from the U. S. Department of Agriculture, and is under the direction of W. C. Davis, Office of Foreign Agricultural Relations. The Agriculturists Association of Guatemala is also taking constructive steps to increase beef production. Some of its members are now arranging for importation of breeding cattle and for the employment of trained ranch managers.

In the livestock-production programs now in the making, emphasis is placed on the improvement of calf crops and animal weights through use of better management and feeding practices, along with development of improved beef types. These efforts are to be accompanied by a campaign aimed at securing a unification of opinion among livestock breeders as to general lines to be followed in the national breeding program. Veterinarians of the Livestock Division of the Ministry of Agriculture are directing their attention to control of parasites, insect pests, and cattle diseases, and they believe that serious weight losses can be eliminated in this manner.

Bright Prospects for Industry

Natural resources of Guatemala are undoubtedly sufficient to warrant the conclusion that livestock production here can and will be greatly increased. On the Pacific slope, particularly at the lower elevations, there are great opportunities for expansion in acreage of pasture lands. This will be accomplished in some places by use of water for irrigation and in other sections by installation of drainage systems.

The long-term outlook for improved beef production in Guatemala is encouraging, provided current attempts to keep foot-and-mouth disease out of the country are successful. Locally prominent livestock producers express the belief that many traditional and detrimental management practices are now being abandoned, and that more and more attention will be given to breeding and feeding problems. The Guatemalan livestock industry is entering a new era of progress and there is every prospect that the country will eventually be able to double its present beef output. On the other hand, it is the conclusion of nearly all concerned that with the steadily increasing local demand for beef there is little likelihood that Guatemala will ever produce more meat than is needed for consumption within the Republic.

Mahogany of Santo Domingo

by ROLLO P. STOVALL

Mahogany has been a useful wood in Santo Domingo, the early name for the Dominican Republic, since the days of Columbus. The Spaniards in Colonial times used this hardwood in the construction of their houses and churches and in building ships. Its value is fully appreciated by the Dominican people, who have made the small white-greenish flower, which blooms from April to June, the national emblem of the Dominican Republic. The municipal government of Ciudad Trujillo has planted mahogany trees as ornamental shade along some of the city streets.

Botanically known as *Swietenia mahagoni*, of the family Meliaceae, the West Indies mahogany is called *caoba* in the Spanish-speaking countries of the Caribbean. *S. macrophylla*, which grows in Mexico and Central and South America, is a faster growing species than the West Indian. The Dominican tree is relatively small and sometimes crooked. Mahogany trees may grow to a height of 60 feet but are usually smaller and are suitable for cutting at 20 to 30 years of age. The lumber produced is sold in random lengths and widths, running from 4 to 16 feet in length, with an average of 10 feet, and from 6 to 20 inches wide, averaging 10 or 12 inches.

Because of the value of the wood, it pays to bring out even small crooked logs. A sawmill operator contracts to purchase from a local *campesino*, or peasant, a felled tree for about $15 a thousand board feet. The log, which may be squared before hauling, must be dragged by oxen for several miles to a primitive road, where it is transported to the seacoast. Since the principal market is Ciudad Trujillo, either the logs or the sawed lumber is taken by coastal schooners to that port. In Ciudad Trujillo the lumber is worth from $180 to $250 a thousand board feet at the present time.

Trees Protected by Law

There are no pure stands of mahogany in the Dominican Republic; instead, the trees are scattered and mixed with other hardwoods. Although they grow in practically all parts of the Republic, the main stands are found in Barahona and Azua in the south, Seibo in the east, and to a lesser extent in Monte Cristi in the northwest. Cutting of mahogany logs has been going on for 450 years. Consequently, the supply of accessible trees near the coasts and roads has been depleted. Lack of water and absence of roads make cutting and hauling difficult.

The exact extent of reserves is unknown, but one mill operator is of the opinion that several million board feet could be cut annually. A United States forestry expert estimates that 4,000,000 board feet could be cut annually and this rate of cutting be maintained for 20 years. Dominican officials estimate that more than 500,000 board feet has been cut annually during recent years. Annual exports of mahogany, timber or logs, during the past 15 years have exceeded 500,000 board feet two or three times, averaging around 250,000 board feet a year.

A law provides that a mahogany tree may not be cut unless 20 trees are planted to replace each one felled. According to the regulations of the Dominican

Mahogany tree at Ciudad Trujillo.

A large amount of old mahogany is used in the manufacture of bowls, book ends, and other novelties.

Department of Agriculture, Colonization, and Livestock, a mahogany tree may not be cut unless the lower part of the trunk is at least 16 inches in diameter. A person desiring to cut down a mahogany tree must apply to the Department of Agriculture for permission.

Fine Quality of Dominican Mahogany

Mahogany wood has beauty, hardness, and durability, and the Dominican Republic has the reputation of having some of the finest quality mahogany in the world, especially for the manufacture of novelties. The wood, with its dark color and attractive grain, takes a beautiful finish and polish. Some United States manufacturers consider the Dominican mahogany too hard and heavy for furniture veneer. Exports of mahogany furniture and novelties from the Republic amounted to approximately $175,000 in 1945 and in the first half of 1946 reached almost $100,000, going mainly to Puerto Rico, the United States, and the Netherlands West Indies.

Mahogany is valuable in the Tropics, because it withstands the inroads of the *polilla*, the West Indian dry-wood termite. To avoid the damage caused by this insect many doors, sills, and other woodwork of houses are made of the wood. The oldest known article made of mahogany is believed to be an old cross in the Cathedral of Santo Domingo. According to the inscription on the cross it was placed on the site of the cathedral in 1514 at the time construction was started. The cathedral, completed in 1550, has many altars and much carved mahogany woodwork which were made in the sixteenth century.

This same resistance to termites makes mahogany furniture a treasured possession in the Tropics. There are several small factories which are turning out solid mahogany furniture. The magnificent new Presidential palace in process of construction in Ciudad Trujillo is to be furnished almost entirely with furniture made in Santo Domingo from Dominican mahogany. In the Temperate Zone, however, where houses are heated, furniture made from air-seasoned lumber is not desirable, because it is likely to split or crack, and Dominican mahogany lumber is air-dried because facilities for kiln-drying are inadequate.

An important phase of the local mahogany industry is the novelty business. Thousands of beautiful bowls, book ends, and other articles are manufactured. The most desirable material for these articles is *centenario*, mahogany over 100 years of age. This old mahogany is found in the form of beams or sills taken from old Spanish buildings which are pulled down to make way for modern houses and offices. The old timbers are more valuable than the pieces of eight which are often discovered in the walls where they were hidden from the buccaneers of the Spanish Main.

In order to maintain sufficient mahogany reserves for the domestic furniture and novelty manufacturing, which expanded during the war years, and as a protective measure for the domestic manufacturers, exportation of precious woods, including mahogany, was prohibited by a Presidential decree in 1945. Unless the precious wood was in a fabricated condition, it could not be exported. In the middle of 1946, however, a Presidential decree modified this restriction so that mahogany lumber could be exported, provided there was a satisfactory supply for domestic needs. Early in 1947 the exportation of unmanufactured mahogany was again prohibited except under extraordinary circumstances.

Mahogany logs ready to be sawed into lumber for furniture manufacture.

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Farming Along Mexico's Highways

by KATHRYN H. WYLIE

Heading south into Mexico, across the international bridge from Laredo, Tex., to Nuevo Laredo, Mexico, is such an exciting experience that all thoughts of agricultural observations are at first lost. The unfamiliar sights and smells entice the senses to enjoy first and seek information later.

In Mexico, however, it is impossible to ignore agriculture—it is the way of life of almost four-fifths of the people. From the characteristic *milpa*, or tiny corn farm, with its smaller patch of beans and chili peppers, to the large cotton-growing region of La Laguna, the land is of primary concern.

We had an opportunity to see a few of the agricultural areas a year ago in July, which is the planting season in many parts of the Central Plateau. Our trip began at Nuevo Laredo and continued down the Inter-American Highway to Antiguo Morelos. From there we turned westward across the Sierra Madre Oriental onto an interior tableland, through the city of San Luis Potosí and on to Guadalajara, Mexico's second city. Turning east again along Lake Chapala we headed into Mexico City, with a side trip to view the spectacle of Paricutín, the new volcano. Mexico City is the hub of the highway wheel, with the spokes reaching out to cities in all directions but with no rim to connect them. As a result, each trip must be made out from the city and back again. Our itinerary took us as far east as Córdoba, as far south as Oaxaca, and as far west as Acapulco.

Mexico's Need of Water In Some Sections

As our car skimmed along the excellent road through the dry desert country just south of the border, we could not help thinking, "How can the people make a living in such dry country!" Low cactus and scrub bushes are practically the only vegetation, and water holes are few and scattered. An occasional cow tried with scant success to find something edible. A herd of goats skipped across the highway at the urging of the goatherd. One of the foremost problems of Mexican agriculture is lack of adequate water for growing its crops.

Throughout large sections of the country arid and semiarid conditions prevail. The whole north central and northeastern part of Mexico receives little rain, as does the northern tip of the Yucatán Peninsula.

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Rainfall is adequate at all seasons in portions of the peninsula and along the east coast. The southern part of the Central Plateau receives from 20 to 25 inches of rain during the rainy season, from June to October, but moisture is inadequate during the remainder of the year. Dry, almost-desert conditions prevail on the road connecting the Inter-American Highway with Guadalajara. For miles on either side of the city of San Luis Potosí the road traverses a dry, arid, inland plateau. Few crops are seen, and the principal occupation appears to be the raising of goats. Small irrigation systems, used years ago but now falling into decay, dot the countryside. Again, some distance south of Mexico City on the way to Oaxaca the characteristic vegetation of this dry and mountainous region is cactus.

The Mexican Government has long recognized that one of the farmer's principal needs is water. Through the efforts of the Irrigation Commission established in 1926 and the recently created Ministry of Hydraulic Resources, Federal aid is being poured into public works to water the deserts.*

Heavier Rainfall Favors Various Crops

South of Monterrey the highway left the dry country and passed through fine groves of orange, lime, and pear trees. The groves were well cared for, and a general air of prosperity was evident. The large farm houses were in sharp contrast to the thatched huts so typical a few miles farther into the valley. We stopped to sample oranges from a roadside market and found their flavor delicious. Still farther south in the neighborhood of El Mante the lowlands are famous for their sugarcane, this being one of the principal areas of production. Here, too, there is a new expanding vegetable-growing industry. It was Sunday as we motored through this valley, and the farm people were laughing and talking along the roadway or bargaining in the village markets.

Dry, almost-desert conditions prevail on the road connecting the Inter-American Highway with Guadalajara. Small irrigations systems, used years ago, but now falling into decay, dot the countryside.

Corn, the principal Mexican article of diet, is found growing in every State, although the biggest part of the supply comes from the southern part of the Central Plateau. This hillside field is along the road to Acapulco.

At Antiguo Morelos a road branches off from the Inter-American Highway to the right to climb onto the interior plateau surrounding San Luis Potosí. Although the plateau itself is largely arid, there are several mountain valleys that are apparently well watered. One particularly fertile valley, into which the traveler can look from the road high above, displayed tall green corn which would have rivaled that of Iowa.

Granary of the Country

Not until one comes within 30 miles of Guadalajara are good growing conditions characteristic over a wide area. Rich black and red soils line the highway in this part of Jalisco, and in early July the farmers everywhere were out preparing their soils for planting, or were cultivating the growing plants. Sometimes there were beans or chili plants, but always there was corn. This crop supplies for Mexicans the principal article of their diet and furnishes at least half of their total calories from all food. Corn grows in every State, but the biggest part of the harvest comes from the southern part of the Central Plateau.

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* *See* "Watering Mexico's Deserts" by Edward C. Higbee in the May 1941 issue, and "Mexico's New Soil and Water Conservation Program" by Phoebe O'N. Faris in the November 1946 issue, of *Agriculture in the Americas.*

This shingle-roofed house on the road to Uruapan belongs to one of the more prosperous farmers.

The wide belt crossing Mexico from northwest to southeast from Jalisco to Veracruz is considered the granary of the country. It produces a wide variety and substantial quantity of other commodities as well as grain. The lower mountainsides of this area were settled by corn-growing Indians long before the time of Cortés and are still more heavily populated than any other section of the Republic.

Around Guadalajara are several herds of fine dairy cattle, the predominant breed being Holstein. The State of Jalisco, in which Guadalajara is located, has more cattle than has any other. Not far away grow the large luscious pineapples that are sold in the market at Guadalajara.

Leaving Guadalajara, the highway to Mexico City follows the shore line of Lake Chapala for several miles. Agriculture is prosperous here, as the tile roofs on the houses testify. Although the farmer usually plows with oxen hitched to a steel-pointed stick, the land yields well for these hard-working folk. And almost the only crop one is conscious of is corn.

Throughout the length of the Inter-American Highway in Mexico as well as across the great Central Plateau, mountains are a determining factor in agriculture. Sharp peaks and rugged terrain break up the land so that cultivation is limited primarily to the mountain valleys or relatively level stretches along the ridges. Such is the case along the roads leading into Mexico City from all directions. Lake Chapala and Lake Pátzcuaro form two natural focal points for more intensive agricultural use of the land.

As we neared Mexico City, we could look down from the heights into the fertile Valley of Mexico. Herds of dairy and beef cattle graze throughout the Valley. In midsummer the fields are green with an abundance of growing corn and lesser quantities of other crops. Here, too, are fields of maguey, or century plants, from which come both the juice for pulque and tequilla and the fibers for twine. Much of this area was once a lake—Lake Texcoco—and the farmer's problem here is usually one of drainage rather than lack of moisture. In most years the summer rains can be depended upon to furnish this Valley with sufficient water, although an occasional hailstorm sometimes results in considerable crop damage.

Lowland Agriculture

An entirely different kind of agriculture is typical of the lowlands nearer the Gulf coast. Dropping down from the dry plateau east of the city of Puebla, the highway reaches an area of tropical-to-subtropical vegetation. Banana trees are seen from the highway around El Fortín and Orizaba, and fine coffee trees furnish an important share of the farm income in the vicinity of Córdoba a little farther to the east. Dense vegetation proclaims abundance of rainfall. The moisture and the hot sunshine produce a wealth of colorful flowers as well as food crops. Orchids, gardenias, and bougainvillaea line the roadways, and in the little village of Fortín the traveler is greeted with a necklace of fragrant gardenias.

Generally speaking, the lowlands west of the Central Plateau are not as well developed agriculturally as those to the east. Along the highway from Acapulco to Taxco, for example, cultivation is scattered and in small patches. The population is sparse in this region, and the terrain is unsuited to any large-scale agricultural enterprise. We did see farmers, however, trying to grow small plots of corn on mountain slopes too steep even for oxen power.

After we had climbed back onto the plateau, the wide Cuernavaca Valley furnished a wonderful con-

Market scene in Uruapan.

trast, with its fields of sugarcane, rice, and the ever-present corn. From here through Cuautla to the Matamoras Valley the natural moisture is supplemented by irrigation. Many cattle are pastured in this region, and a tractor is seen from time to time.

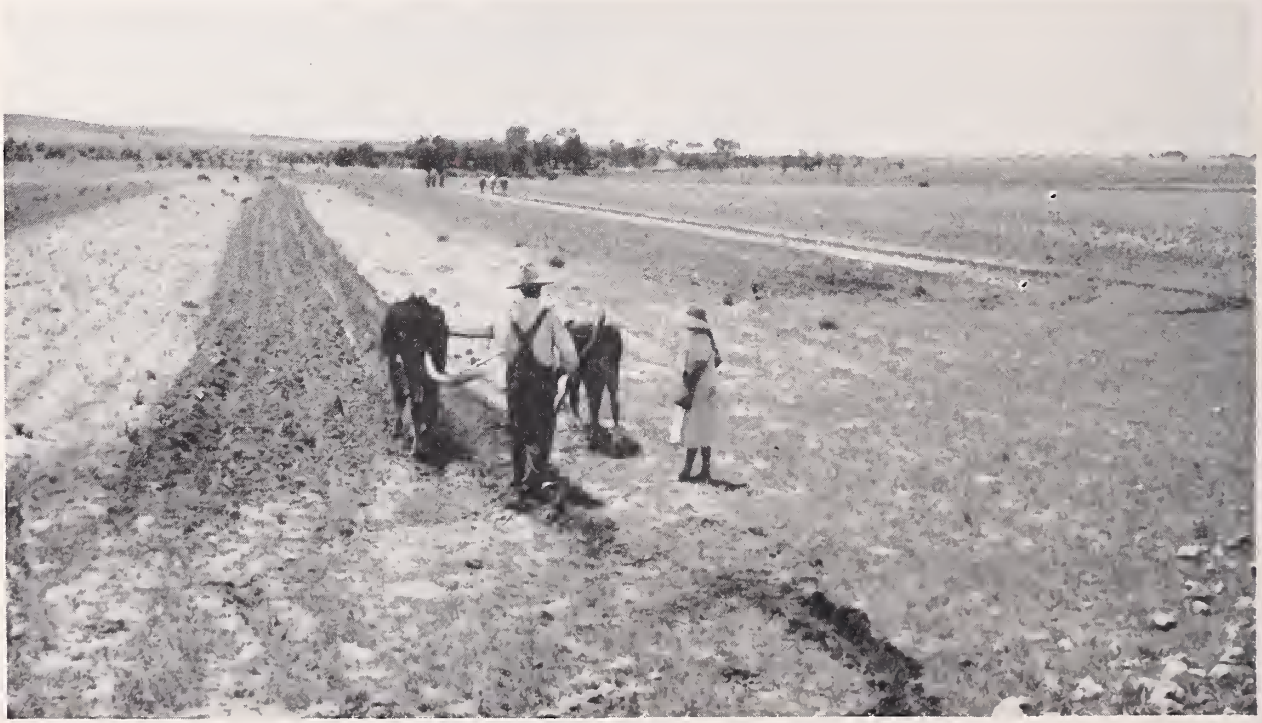
Market Day

Most of the products of agriculture are sold in open-air or covered markets, held usually once a week in a village or nearby town. Saturday is market day in Oaxaca, and early in the morning the farmers come into town from all directions either riding burros or walking. They set up shop on the sidewalk or in a corner of the street, spread their beans or chili or herbs on a cloth, and are ready for business, or gossip with their friends.

As we made our way slowly through the crowd, we saw a woman busy grinding corn for her tortillas, using a metate, or curved stone base, and a second stone resembling our rolling pin. On another corner a family was gathered around a tiny stove on which bubbled a savory concoction made of beans and, we suspected, chili. Later in the day we stopped to sample a particularly enticing morsel called an *empanada*. We watched the cook as she deftly molded a tortilla, placed in the center bits of what appeared to be white cheese and parsley, folded it turn-over fashion, sealed the edges, and fried it in deep fat.

Much farther north, on a stretch of the Inter-American Highway between Tomazunchale and Valles farmers and their wives were carrying products of a more tropical nature into the village for the weekly market. One tiny man was running along the road, stooped over nearly double by the weight of two stems of green bananas which he balanced on his back. Coming into the town from the other direction was a barefoot brown-eyed beauty wearing a bright blue satin dress. We marveled at the pleasure the neighbors were having together as they disposed of their farm produce and purchased whatever they could to supply their wants until another market day.

We had neither the time nor money to visit the large-scale commercial agricultural areas, such as the Laguna cotton-growing region, the west-coast winter vegetable fields, or the big wheat farms of Coahuila. But for the majority of Mexican farmers those large undertakings are not typical. Many of them still plant their small patches of corn and beans, grind the corn for their tortillas, and trade their meager surplus in the village market. As we traveled homeward, these industrious farmers remained our most vivid memory.



Farmers plowing with oxen hitched to a steel-pointed stick.

More Guavas in Puerto Rico

Dwellers in Temperate Zones are learning more and more to appreciate the fruits that grow in the Tropics and to enjoy the products which are made from them. One of these newly popular and highly useful fruits is the guava.

by RUBEN H. FREYRE

The Guava is a fruit which deserves more attention than it has received in Puerto Rico. In 1945 Cuba exported 6,000 short tons of guava products. In British Guiana, guavas are said to yield 10,000 pounds a year to an acre from mature selected varieties. In Puerto Rico, the Agricultural Experimental Station of the University of Puerto Rico at Río Piedras and the Federal Experiment Station at Mayaguez have been experimenting in development of the different varieties of guavas and have distributed young trees to locally interested people, but there is room for much more development of this useful fruit.

Guava Is Native To American Tropics

The guava is the most important pomological fruit of the Myrtaceae, the family to which belong also many spices, the eucalyptus, and various ornamental plants. Its native home is the American tropics, and it is widely distributed where frosts are not severe and rainfall is sufficient to support vigorous growth. It is grown in continental United States from southern California to Texas, the Gulf coast, and Florida, and cold seems to be the only hazard in these areas.

In Puerto Rico the guava grows in nearly all types of soils and at all elevations from sea level to 3,500 feet. It is one of the least exacting fruits in culture requirements, growing even under unfavorable conditions of soil and competition from other plants. In fact, wild seedlings may be considered a weed in pastures. For high production and best quality of fruit, however, introduction of superior varieties and careful practices of cultivation are necessary.

The common guava, *Psidium guajava* Linn., has a number of varieties. Among the superior varieties are the Dominican Red and White, the well-known Redland and Rolf, and three new selections from the Subtropical Experiment Station, Homestead, Florida—the Supreme, Red Indian, and Ruby. The strawberry guava and the Brazilian and Costa Rican guavas belong to different species of the same genus and have varieties of their own. At Río Piedras a variety known as Puerto Rico Selected is giving good yields and has high quality. Members of the Experiment Station at Mayaguez have introduced choice types of Cuban, Peruvian, and Mexican guavas.

The Fruit

Guavas grow on shrubs that if left undisturbed develop into small trees. The trunk, which has a grayish-brown scaly bark, may attain 6 inches in diameter. The leaves approach an oblong shape and are from 3 to 6 inches long. The lower surfaces are finely hairy and heavily veined, and the leaves give off a peculiar aroma when crushed. The white flowers are alone or in small clusters upon a slender peduncle.

Clusters of strawberry guava developing during the first year in the field.

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Guava fruits vary in shape from round or ovoid to pear-shaped, and in size from 1 to 3 inches in diameter. The weight of individual fruits ranges from 3 to 6 ounces. The skin is commonly yellow, but green-skin ripe fruits may occasionally be found. The color of the flesh varies from white or yellow-white to deep pink or salmon red. Thickness of shell varies among fruits, and there are types in which the pulp occupies only a very small core. The small hard seeds are embedded in a soft pulp which is sweet, somewhat acid, and has a highly pronounced musky aroma when the fruit is ripe. Fruits may be set singly or in clusters of two or three fruits. There is one common type of fruit on the Island which is usually too small and thin-shelled, with too many seeds and too much acid to be used for eating, but it is particularly suitable for making jelly because of its high pectin content.

Cultivation Practices

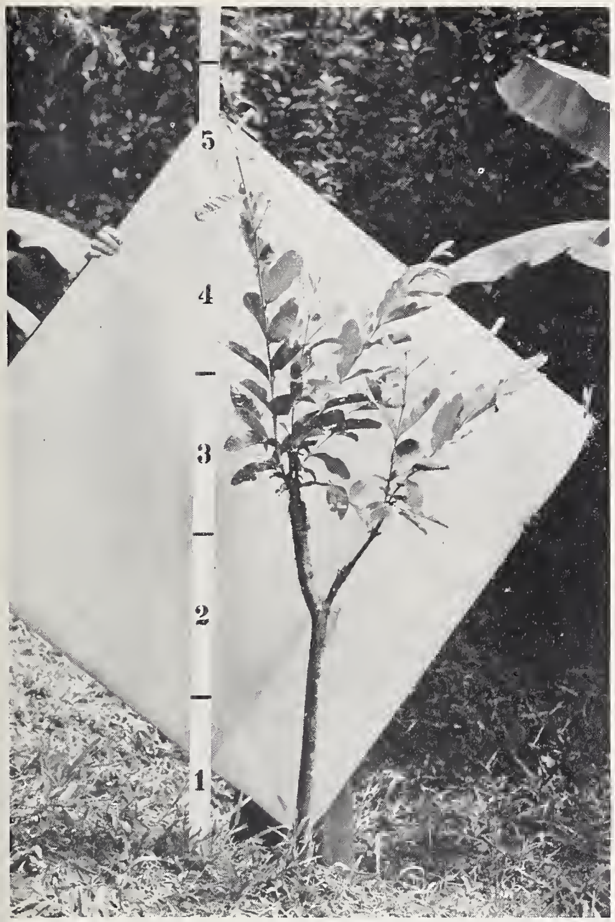
If guava trees are to be grown from seeds, the seeds should be sown in flats and covered to a depth of a quarter of an inch. After they have produced their second leaves and are from 6 to 8 inches in height, they may be transferred to pots and grafted with scion wood of the selected varieties. Because guavas hybridize easily and produce heterogeneous seedlings, and because the shape, size, color, and taste of the fruits vary greatly, it is recommended that guava be propagated only by vegetative methods, such as budding, grafting, or layering. Scions of standard varieties or of superior selections should be used.

When the plants are 2½ feet high, they are transplanted in the field about 15 feet apart. Pasture, vegetable, or minor crops can be successfully interplanted with guava. Early summer is the best season for planting in Puerto Rico, at which time lack of moisture should not be a limiting factor in becoming established. Bearing begins about 2 years after transplanting and may continue for 20 or more years. Bearing season is in late summer and autumn. Soil around the trees should be tilled each year, and fertilizer applied. Little pruning is recommended.

Guavas are subject to certain insects and diseases in Puerto Rico. West Indian fruitflies (*Anastrepha suspensa* Loew. and *A. mombinpraeoptans* Sein) and the coconut mealybug (*Pseudococcus nipae* Mask) are among the most troublesome insects. To destroy the coconut mealybug, a parasite, *Pseudaphycus utilis* Timb., which attacks the mealybug, was introduced into Puerto Rico from Hawaii by the Federal Experiment Station in 1939. It has proved effective in the areas where it has been liberated and should gradually spread over the whole island.

There is a rather common disease of guava characterized by the mummification and blackening of the fruit. This is caused by the fungus *Glomerella rufomaculans* (Berk) Spald. and Schrenk, which is occasionally severe on certain selections and on the native

Main Administration Building at the Federal Agricultural Experiment Station, Mayaguez, P. R.



Cleft-grafted Redland guava 2 months after insertion. Three scions 6 inches long and approximately 1/4 inch in diameter were used.

fruits. Effective control measures for this disease have not yet been developed.

Guavas Have Many and Varied Uses

People in the Tropics use guavas in many ways. They may be eaten fresh from the tree, or may be cooked and preserved. Like bananas, guavas are delicious when sliced and eaten with cream or in shortcakes and pies.

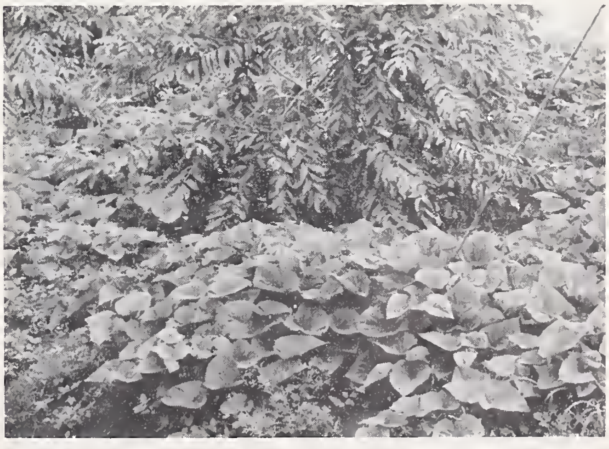
Exportation of guava to the United States must be restricted to its commercial products only because of quarantine regulation against the West Indian fruitfly which infests the fruits. Products made from the fruit, however, give it considerable importance. Guava jelly has a beautiful deep wine color and is clear and firm. Its flavor has the same acrid muskiness that is characteristic of the fruit. Another guava product commonly used in Puerto Rico is guava paste. This is made by evaporating the strained guava pulp until it is of thick consistency. Guava wine and liquor have been produced by the Agricultural Experiment Station at Río Piedras.

Guava fruit is a source of vitamins A and B and, especially, of vitamin C. The ascorbic acid content of the juice makes it a good substitute for orange or tomato juice. Guava juice has been successfully used in Hawaii to feed infants.

Recent military needs have stimulated additional research to study the possibilities of guava as a large-scale source of vitamins. One project is reported in which unpeeled quartered guavas were blanched and the central pulp and stones removed. The remainder of the fruit, the amount depending upon the thickness of the shell, which is a varietal characteristic, was dried at 130° F. for 10 to 12 hours, and a tasteless but aromatic powder was obtained. This powder was used extensively by the British troops as a rich source of vitamin C during World War II. One hundred grams of the powder contains from 2,500 to 3,000 milligrams of vitamin C. This means that a little over 4 ounces of the powdered guava would protect an Arctic explorer from scurvy for 3 months.

Puerto Rican Conditions Suit Guava Plants

The guava plant grows easily in Puerto Rico. It fruits early and profusely. Moreover, its growth is not retarded by interplantings of various crops, such as sweetpotatoes. The many uses of the fruit may well make larger production of guavas a source of increased income in areas little used for other economic crops.



Brasiliensis blanca variety of guavas at the Puerto Rico Agricultural Experiment Substation at Isabela, intercropped with sweetpotatoes.

Potentialities of Sesame as a Commercial Crop

by D. G. LANGHAM

In India and China sesame has been used as a food since 450 B. C. The Western Hemisphere, however, has been somewhat slow in recognizing the value of this seed crop, which has a high protein content and contains a good-grade edible oil in quantity up to 50 percent of its weight. It has been used as an ornamental plant and to a lesser extent as an oil crop, but not until the extreme shortage of vegetable fats and the high prices of recent years did it assume any appreciable importance.

One reason for this slowness in development is the difficulty of mechanical harvesting. Sesame-seed pods open so easily at maturity that the entire crop of seeds may be lost if harvesting is delayed. Furthermore, the pods on a stem of sesame do not ripen and open uniformly but at different times. Thus, harvesting sesame by machinery has been impractical.* In this hemisphere the word harvesting usually implies the use of machinery. For a Westerner, the risk involved in growing large acreages of a crop that must be harvested by hand rather than by machinery is too great.

Venezuela Experimenting In Breeding Sesame Plants

Whether or not sesame will ever become a major crop in the Western Hemisphere depends on how successfully the plant can be altered to meet modern requirements of mechanization. At the *Instituto Nacional de Agricultura* in Venezuela geneticists have been experimenting along this line. Certain progress has been made in developing a single-stalk plant, known as VENEZUELA–51, which ripens more uniformly from base to tip, and in isolating an indehiscent mutant, or nonshattering variety. This new gene for the closed seed pod must be transferred to high-yielding varieties, and certain inherent defects must be corrected. A great deal remains to be done in this attempt to breed sesame plants which can be harvested by machines, but it is hoped that the problem will be solved in the near future.

Another problem is likely to be disease control. For the early domesticators of sesame, and indeed of many other plants, this factor hardly existed. Plant populations were small and isolated from one another. Modern intensive agriculture has changed all this. Now plant breeders must have in their collection the complete range of varieties, including the wild types and all the closely allied species, in order to breed for natural disease resistance. As the diseases themselves change, the struggle is never ending. In the program for improvement of sesame particular importance is given to the use of wild varieties and other related biotypes.

Importance of Sesame

Although the principal importance of sesame seed is measured in terms of its edible oil, its other values as a human and animal food must not be overlooked. It is eaten whole as a seed in various combinations of

VENEZUELA–51, a single-stalk early variety of sesame which ripens uniformly and is adapted to mechanical harvesting, is being developed at the *Instituto Nacional de Agricultura*.

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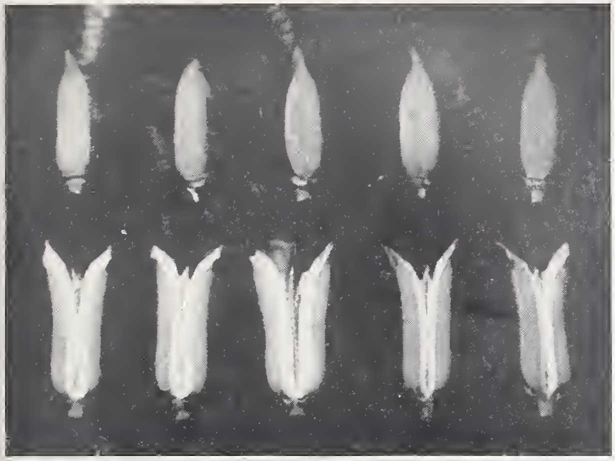
* *See* "Sesame", by Dale E. Farringer, in the October 1946 issue of *Agriculture in the Americas*.



The bottom row of seed pods are of ordinary sesame which shatter at maturity. The top row of pods are of the new nonshattering variety.

bread, cake, and candy or used in prepared liquid refreshments. Press-cake residue from the oil mills is an important source of protein and is especially high in phosphorus and calcium. Experiments with milk cows, chickens, horses, and other animals have consistently demonstrated the feeding value of this byproduct from the oil mills. Recent research on the use of this meal cake, in combination with peanut meal, in feeding experiments with white rats has indicated the advisability of commercially preparing sesame meal for use in the human diet. In certain Latin American countries where corn is the principal part of the daily meal, a small addition of this tasty protein concentrate would considerably improve the value of the food. In Venezuela, *arepa*, a pancake-like preparation of corn, is the national bread. The addition of 10 percent of sesame meal is being tried, and the resulting product, more agreeable to the tate and with a decided increase in nutritional value, is meeting with public approval.

As a carrier in medicine, particularly for intermuscular injections, the value of sesame oil has long been recognized. It is also used for the dispersion of insecticides and is well known as an ingredient in aerosol bombs. More recently it is being used as a synergist to pyrethrum, doubling the effectiveness of that insecticide in killing the common housefly.

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Outlook For Commercial Production

The total production of sesame in each of the countries in the Western Hemisphere is not large. Mexico and Nicaragua made certain increases during the war, but the total output, compared with that of other crops, is still insignificant.

A striking feature, however, is that within the past 2 years Venezuela has received requests for sesame varieties from each of the countries in Central and South America and from several States in the United States. Nearly all the requests stated that sesame-breeding programs were being initiated because of local interest in commercial production.

Plant breeding must keep pace with the needs of the farmers. If production is increased too rapidly, before nonshattering varieties can be fully developed, it is likely that major losses due to difficulties of harvesting may disillusion the farmers. If diseases, such as *Fusarium* in Central America, are not controlled, or if improper handling of cultivation problems is allowed to prevail because of lack of experience and knowledge, the industry may receive a major setback. A slow but steady increase in commercial production would be welcomed by the men in the experiment stations who are striving to gain more information about the production of sesame as a potential commercial crop for the Western Hemisphere.

Resistance to insects: On the left is a local variety of sesame which has been destroyed by aphids; on the right is the improved variety, VENEZUELA-52, undamaged.

Reading about the AMERICAS

Raising Turkeys, Ducks, Geese, Game Birds, by Morley A. Jull. 467 pp., illus. McGraw-Hill Book Company, Inc., New York, N. Y., 1947. The author, long an authority in the poultry field, here provides up-to-date information on raising and marketing turkeys, ducks, geese, guineas, pigeons, peafowl, upland game birds, and aquatic game birds. His discussions of the problems involved in the actual production of poultry are intended primarily for the use of vocational agriculture students, other farm youth, and their parents, and for anyone specializing in the raising of any of the birds mentioned.

The Soil and Health, by Sir Albert Howard. 307 pp., illus. The Devin-Adair Company, New York, N. Y., 1947. This book is the result of a life-long study of the crops of the West Indies, England, Europe, Asia, and Africa, by the author of *An Agricultural Testament*. The thesis is that "food problems begin as soil problems, and can only be solved, locally or universally, by an understanding of what a fertile soil is, and how you help nature re-create soil to make it fertile and able to produce health-giving food. . . ." Section headings are: The Part Played by Soil Fertility in Agriculture; Disease in Present-Day Farming and Gardening (including diseases of the soil, of individual crops, and of livestock); The Problem of Fertilizing.

Política Agrícola-Alimenticia, by Gerardo Klinge. 430 pp., tables. Sociedad Nacional Agraria, Lima, Peru, 1946. The Conference on Food and Agriculture held at Hot Springs, Va., in 1943 established a long-time farm and nutrition policy for all countries. In this book the author applies those general principles to the particular case of Peru, discussing the agriculture of the different parts of Peru, the production of many kinds of foods, including cereals, fruits, and meats, and various related subjects.

Cuban Counterpoint: Tobacco and Sugar, by Fernando Ortiz. Translated from the Spanish by Harriet de Onís. 312 pp., illus. Alfred A. Knopf, New York, N. Y., 1947. "Tobacco and sugar have made the history, the character, and the economy of Cuba." In entertaining style, the author examines not only the economic aspects of these two important crops but their effects on folklore, art, science, industry, and daily human living. In the second part of the book he discusses the history, the ethnography and, what he calls, the social phenomenon of transculturation of Havana tobacco and the beginnings of sugar in America. A glossary of Spanish terms used and an index are included.

Avicultura, by Morley A. Jull. 598 pp., illus. Union Tipografica Editorial Hispano-Americana, Mexico City, D. F., 1947. This is a translation into Spanish of *Poultry Husbandry*, which is published in New York, N. Y., by McGraw-Hill Book Company, Inc. The author presents the background of the poultry industry, the fundamental principles involved in various poultry practices, and information concerning methods of poultry production. He considers also important economic factors in producing and marketing poultry products.

Industrialization of Latin America, edited by Lloyd J. Hughlett. 508 pp., illus. McGraw-Hill Book Company, Inc., New York, N. Y., 1946. A symposium on Latin American industry by 30 business leaders from the United States and Latin America. It interprets and evaluates trade potentialities, analyzes economic trends affecting manufacturing activities, and attempts to anticipate the direction of future developments in certain industries such as chemicals, mining, textiles, food packing, power, and communications. Of particular interest to those concerned with agriculture are the chapters on the food industry, the leather industry, the sugar industry, transportation, and the pulp, paper, and lumber industry. In each chapter the subject is discussed in general and under separate countries.

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U. S. GOVERNMENT PRINTING OFFICE: 1947

Gifts of the Americas

ANNATTO

by JANE W. ROLLER

Annatto of commerce, a reddish-yellow dyestuff, comes from the rusty-amber pulp surrounding the seeds of *Bixa orellana*. Linnaeus named this native of the American tropics after Francisco de Orellana, discoverer of the Amazon. The tree grows in a variety of climates, from steaming lowlands to high sierras, but Brazil is said to be its original home.

Bixa is an attractive tree with entire, heart-shaped leaves, and terminal panicles of large, five-petaled pinkish-to-rose flowers, which are produced three times a year. Seeds are borne in globose, two-valved capsules covered with soft spines.

Two pigments, bixin and orellin, are obtained from the seed pulp. For extraction, the seeds are stirred in water until the pulp is dissolved. After the water is evaporated, a paste remains containing the pigments. Crystallized bixin is obtained by treating the seeds in chloroform for 2 days, then evaporating the liquid. Exports to the United States are generally in the form of whole seeds.

Jamaica, Ecuador, British India, and Brazil are the principal sources of world supply. Imports of annatto into the United States were better than a million pounds annually from 1936 to 1942. Then prices almost tripled, and importation fell in 1942. In 1943 it rose again to almost a million and a half pounds. With still higher costs and shipping difficulties, plus the availability of a harmless certified coal-tar dye, imports of annatto went down to less than 7,000 pounds in 1944. Today most of the pigment furnished with oleomargarine is a coal-tar dye which has been tested and approved by the Government. For many, however, annatto still remains the favorite and in tablet form is used in farm and home cheese making. Commercial cheese varieties owe their pleasing primrose and cowslip yellows to annatto. Seventy-two percent of all imported annatto is used in this way; 23 percent gives butter its characteristic tint; and the remaining 5 percent is used in ice cream.

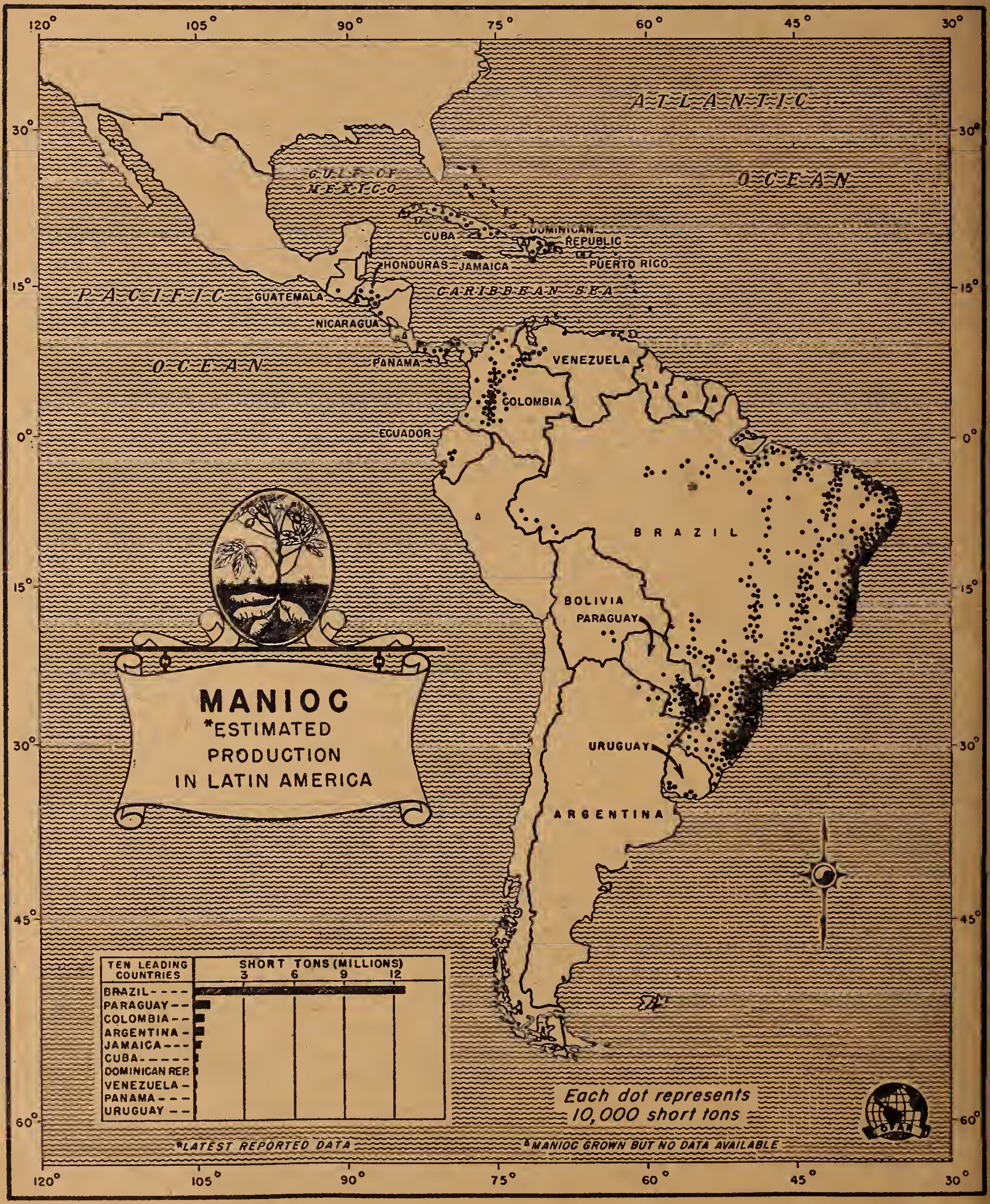
Annatto possesses a long and colorful history. Columbus found the savage Carib Indians using annatto as a war paint. The Colorado Indians, "red men" of Ecuador, today process the pulp in such a way that it yields a red dye. This is used as a body paint to repel gnats, mosquitoes, and other objectionable insects. But the men have the edge on insect protection, for their womenfolk are allowed to paint only the face.

Gradually annatto was introduced into other warm parts of the world. It became a commercial crop in Ceylon, India, and the East Indies, as well as in the Western Hemisphere.

Before the advent of aniline dyes, many tons of seed, extract, and paste were extensively used in the dye industries of England and Germany, even though the dye is a fugitive color and fades on exposure to strong sunlight. A bulletin issued by Kew Gardens in 1887 lists the following current uses of annatto: Coloring jellies, hair soap, candles, pomades, spirits, and confectionery; in making lacquer for brass work; in dyeing calico, silk, wool, rugs, straw, split feathers, wood, ivory, and bone, or anything else that would take the color. Annatto is added to chocolate, particularly the cheaper grades, to enhance its color and flavor. A tough bast fiber in the bark of *Bixa* is sometimes made into twine. A gum similar to gum arabic is obtained from the tree. Pulp from the seeds is used in the Tropics as a remedy for skin diseases and for healing burns without leaving a scar.

As many yellow fruits and vegetables contain vitamin A, annatto was tested as a source some years ago and found to have 2 percent. In many Central and South American countries annatto is used in rice much as the condiment paprika is used. It has been said that the teeming population of Puerto Rico, one of the most densely inhabited regions in the Western Hemisphere, owes its existence partly to annatto. The tropical diet is particularly devoid of vitamin A, and this product, present in the Puerto Rican's rice bowl as a condiment, provides him with a minimum allotment.

Recent trends have been to supply chickens and stock with annatto as a vitamin supplement. However, it is reported that the flesh of hogs which had eaten washed annatto residue was of an odd color, harmless, but unnatural enough in appearance to be unsalable.



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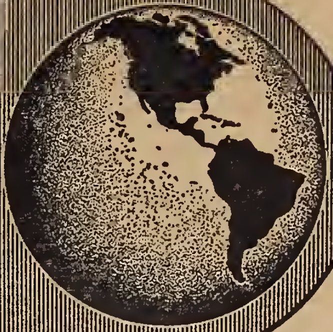
Agriculture IN THE Americas



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October–November 1947

NAMES & NEWS

Members of Office Staff at FAO Conference

The United States Delegation to the Third Session of the Conference of the Food and Agriculture Organization of the United Nations included, among others, the following staff members of the Office of Foreign Agricultural Relations: *Leslie A. Wheeler,* Director, as Alternate Member; *Duncan Wall,* Special Assistant to the Director, as Technical Secretary; and *Beatrice Dufrane, Evelyn Jonas,* and *Marion Pasbach.*

Dr. Groszmann Returns to Brazil

Américo Groszmann, Agronomist of the *Departamento de Génetica, Escola Superior de Agricultura,* Visçosa, State of Minas Gerais, Brazil, has returned to his home after 2 years in the United States. While here, he made a study of agricultural organization and cooperation and crop breeding.

Claud L. Horn in Central America

Claud L. Horn, Head, Complementary Crops Division, left early in September for Central America to confer with the staff in Nicaragua, El Salvador, and Guatemala, concerning the research work being conducted in those countries. He planned also to attend the Pan-American Technical Cacao Conference at the Inter-American Institute of Agricultural Sciences at Turrialba, Costa Rica, and to return to Washington via Cuba.

Jorge Spangenberg a Visitor from Uruguay

Dr. Jorge Spangenberg, Professor, Agriculture Faculty, University of Montevideo, and Chief, Seed Service, Uruguayan Agricultural Ministry, is visiting in the United States for the purpose of studying farm machinery—tractors and harvesters—sugar-beet cultivation and related genetical problems, and grain sorghums.

Francis Flood Assigned to Canadian Post

Francis A. Flood, formerly Associate Director of the Office of Foreign Agricultural Relations, has gone to Ottawa, Canada, as Agricultural Attaché at the American Embassy.

Dr. Leonard Now Director in Bolivia

Dr. Olen E. Leonard, who has been conducting agricultural research and extension work in Bolivia to encourage increased production of crops complementary to United States agriculture, was a recent visitor to Washington. He has since returned to Bolivia to serve as Director of the cooperative agricultural stations in that country.

Robert Moncure Assigned to Guatemala

Robert C. Moncure, Agriculturist, OFAR, has gone to Guatemala to work on various horticultural and plant-introduction problems at the *Instituto Agropecuario Nacional.*

Dale Farringer in the Dominican Republic

Dale E. Farringer, formerly a member of the American Embassy staff, Managua, Nicaragua, has recently gone to Ciudad Trujillo, Dominican Republic, to serve as Economic Analyst at the American Embassy there. He succeeded *Rollo P. Stovall,* who has returned to the United States to accept a position on the faculty of the University of North Carolina at Chapel Hill.

Dr. Birdsall on Mission to the Philippine Islands

Benjamin J. Birdsall, Assistant Head, Station Management Division, OFAR, has been in the Philippine Islands since July 1 on a special mission to the Philippine Government. He expects to return to Washington in October.

Dr. Cowgill Returns to Post in Guatemala

William H. Cowgill, Horticulturalist at the *Instituto Agropecuario Nacional* in Guatemala, is returning, with his family, to that station after conferences in Washington and an extended vacation in the United States.

Agriculture IN THE *Americas*

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Andullo and Perique—Dominican and Louisianan Tobacco

For pipe smokers in the Dominican Republic a long andullo roll of tobacco is most popular. In the United States the corresponding form of tobacco is known as perique. The authors tell how the two forms are prepared.

by HARRY A. ALLARD
and HOWARD F. ALLARD

Of ancient origin is the Dominican Republic method of preparing tobacco in the long rolls known as *andullos*. It may even have originated with the Indian inhabitants of the Island before the Spanish settlers came. Perique tobacco is grown and processed in Louisiana by a French method. Settlement of the French Acadians in Louisiana occurred much later than the Spanish settlements in the West Indies. The French may well have borrowed the idea of processing tobacco from the method of *audullo* making which they found in use in the Caribbean area and modernized it into the present method of preparing perique tobacco.

Whatever their origin, the two methods and the resulting products are so similar that it is interesting to consider the two together. In both a process of long-continued pressure is required, followed by months of slow ripening and aging under continued pressure, until both products are densely compacted and darkened almost to blackness by the reabsorbed juices and gums compressed from the original leaf mass.

Andullo Tobacco in the Dominican Republic

Andullo tobacco in the Dominican Republic is a tightly compressed slender roll 5½ to 6 feet long, which is used mostly for pipe smoking. It constitutes an important product in that country and is exported to neighboring West Indian Islands and nearby Caribbean countries, including Haiti and the Dutch West Indies. Formerly it appears to have been much more extensively exported in this region. In 1933, more than 291,000 pounds of Dominican *andullos* were exported, but in 1942, probably as a result of the war, exports had dropped to about 2,000 pounds.

In the West Indies, tobacco is grown during the cooler, drier winter season. Seed is sown for the most part during the first 15 days of October in order

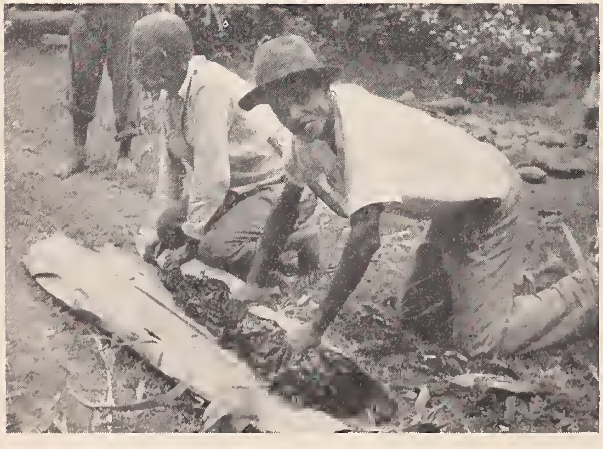
Workman holding armful of tobacco, the quantity of leaf used in making an average-size *andullo*.

to secure suitable plants for transplanting in the field in November and December when showers are frequent. Harvesting takes place in March and April. The leaves are picked individually and are placed in bunches of 2 to 4, depending upon their size. Held by twisted strands of royal-palm leaves looped around the petiole base, they are hung on strings. These strings of tobacco, called *sartas*, are suspended in *ranchos* or open drying sheds to cure.

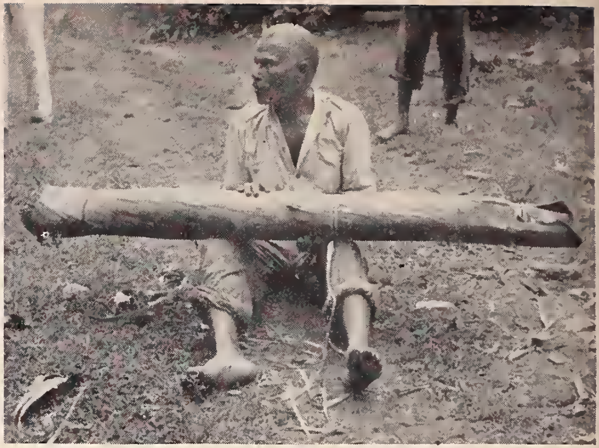
Cigar tobacco is the only type grown in the Dominican Republic. Of this, two major classes are produced—*olor* and *criollo*. As *olor* includes the choicest cigar types, this leaf is reserved almost entirely for domestic consumption in cigars and cigarettes. *Criollo* includes the less desirable types and is grown for export, largely to European markets, to be made into cheap cigarettes and plug tobacco for pipe smoking and chewing. Being stronger and heavier than *olor*, *criollo* is generally used for making *andullo*.

Making Andullo is Ingenious Process

When the tobacco has been partially cured by hanging in the *rancho* for about 2 weeks, it is arranged in bundles, each containing 15 to 20 leaves. For an average *andullo* of 5½ or 6 feet in length about 12 bundles are used. A covering known as a *yagua*, which is the expanded base of the indispensable royal-palm leaf, is obtained and wet in the river to render it soft and pliable. The strings are removed from the bunches, and the loosened leaves are distributed along the *yagua* in such a way as to make a uniformly shaped roll with tapering ends when completed. The leaves with their *yagua* covering are firmly rolled up, and the roll is tied with strips cut from royal-palm leaves. It is now ready to be wound and compressed by an ingenious and efficient manipulation.



All the tobacco now placed along the wet *yagua* is tightly rolled and tied.



The *yagua,* filled and tied, is ready for the next step, winding with rope to compress it.

A rope 60 feet in length and ½ inch or even smaller in diameter is used. This may be either imported or locally made sisal rope. One end is firmly tied around the middle of the *yagua*-covered roll of tobacco. The other end is carried around a tree trunk and back to the roll. One turn of the rope is made around the roll, and the loose end is then carried in the opposite direction and tied to another tree. The roll is now supported some distance above the ground by two parallel strands of rope on one side and by a single strand on the other.

A man sits on the two parallel strands to increase the tension on the roll. The *andullo* is now rotated in the direction of the sitting man. This rotation causes a close spiral winding of the *andullo* by the first strand, which was tied to the middle of the roll. At the same time the parallel strand, serving only as a moving compression force upon the roll, constantly unwinds just ahead of the lengthening spiral zone. As the winding continues, the spiral finally reaches the end of the *andullo*, and a loop of the spiraling coil is made at this end to prevent unwinding.

Harry A. Allard was formerly Senior Physiologist in the Tobacco, Medicinal and Special Crops Division, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Department of Agriculture. Howard F. Allard, an Agronomist in the Bureau's Division of Rubber Plant Investigations, is stationed at Cuidad Trujillo, Dominican Republic.

The single strand of rope is untied from the tree and the continuous piece of rope from the spiral is passed down the *andullo* to the unwound portion, for the rope is never cut. The *andullo* is now flopped over, the compression rope is again fastened to the tree, and the winding of the other half of the *andullo* is continued just as before until the spiral reaches this end.

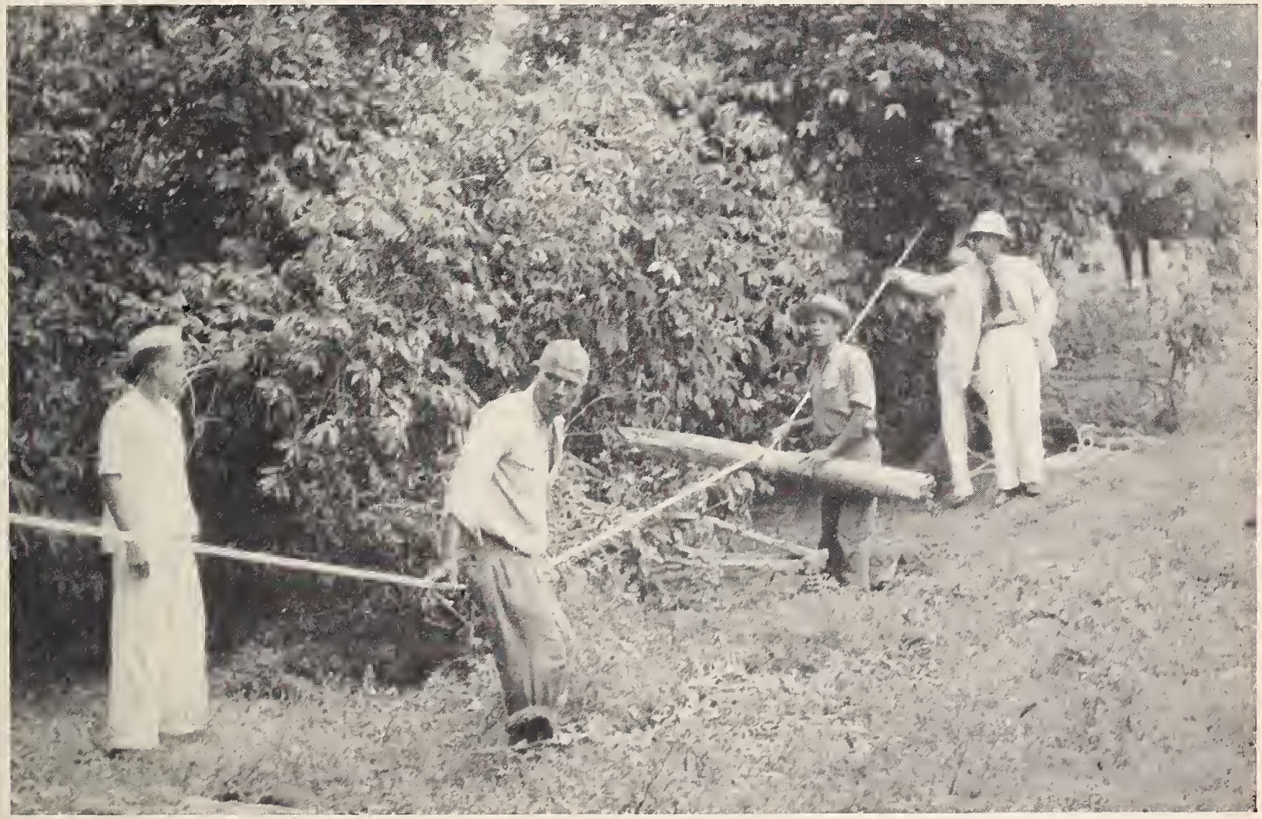
The next day the rope is removed, and the *andullo* is again wound in exactly the same way, using the tension of a man's weight as before. This compresses and compacts the roll still further. The rewinding process is repeated daily for 8 days. After the eighth day the roll enclosed in its winding of rope is left for about 2 to 3 weeks, or until the rope spiral shows slackness. It is then again rewound very tightly. Rewindings are repeated every 2 or 3 weeks for 4 to 6 months. By this time the *andullo* is dense and will retain its shape without the rope.

Green or fresh *andullo* which has just been made is bought by sight, not by weight. In this condition it sells for $3.00 to $4.00 per *andullo*. When it has been processed for 4 to 6 months, it is bought from the farmer or *campesino*, as he is called in the Dominican Republic, at 40 to 50 cents a pound and sold at retail by the small storekeepers at 60 cents a pound. So heavy, compressed, and condensed is this roll of tobacco that it is not readily cut. In order that small pieces may be cut off as needed, the roll is usually held in a wooden V-shaped trough, and a heavy knife, fastened at one end for securing leverage, is forced down directly upon the supported roll.

No statistics are available for the amount of *andullo* made in the Dominican Republic, but it is substantial. Although it is produced wherever tobacco is grown, certain localities are especially noted for the good quality of their *andullo*. These are small communities which have specialized in this native product.

Perique Process Similar to Andullo

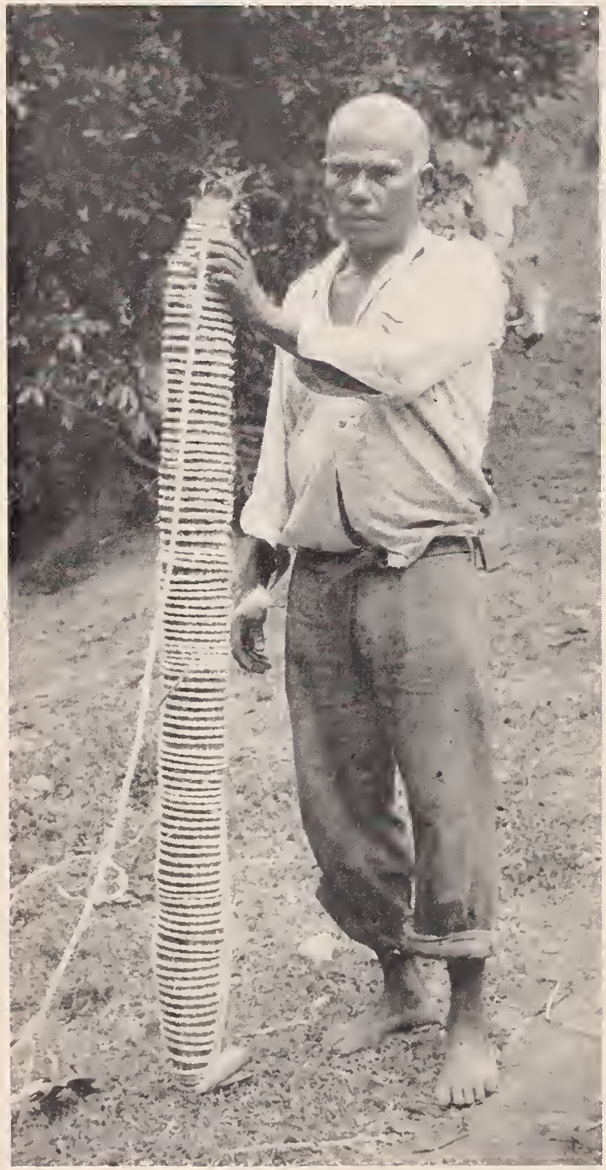
The process of manipulating perique tobacco appears to be similar to that of *andullo*. In both, the tobacco is processed when the leaves are only partially cured, while the leaf is brown and the midrib is still partly green. For perique, the midrib is removed, sepa-



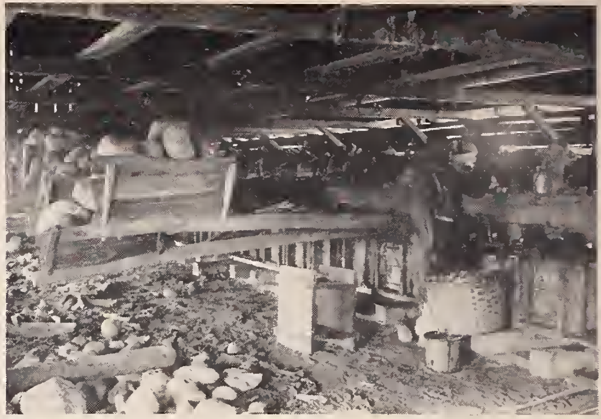
The first step in the winding with rope, which begins at the middle and progresses toward the end of the completed roll. Tension is applied by a man sitting on the two ropes as shown.

rating each leaf into halves. These are made into twists a foot or so long and weighing approximately a pound. While still soft, these twists, about 50 of them, are packed in a strong pressing box, 11 inches square and 16 inches high.

Prior to 1912, boxes were not used. Tobacco was arranged in short cylindrical rolls or *carottes*, weighing 1 to 4 pounds. These were rolled up in strong cloth and then wound with rope kept under heavy tension by means of an ingenious windlass device. The *carottes*, similar in appearance to the *andullo* rolls, were left in their rope windings for several days or until ready to be sold, when rope and cloth were removed and a cover of paper or other material was substituted.



Roll completely wound and left until the next day, when it will be rewound.



Perique tobacco-curing farm, St. James Parish, La., 1909. Formerly heavy loads of stone at the end of the timbers afforded great pressure upon the tobacco packed in the boxes. Now large, powerful screw jacks compress the tobacco in boxes or barrels.

More Modern Practices Adopted

Now boxes are used almost entirely. Pressure is applied to the tobacco in the boxes until black and sticky juices start to ooze from the mass. Formerly this pressure was applied by means of a long lever heavily weighted with stone. Now more conveniently handled powerful screw jacks compress the tobacco into the boxes, or sometimes barrels. Pressure is regulated to prevent running and loss of these juices, because the object is to have them reabsorbed to give a black, gummy appearance to the finished product.

Every 2 weeks the boxes are opened for a day or two and the twists loosened to allow air and moisture to reach all parts of the compressing mass with subsequent uniform reabsorption of the extracted juices. If necessary, the twists are opened and the drier leaves moved to the outside and moistened, a process called working. Sometimes a little petun or rum is sprayed over the layers of twists.

The tobacco is now ready to lay by for aging. Because of shrinkage, the contents of three boxes are put into two. Pressure is renewed, but this time less weight is used. In this state the tobacco is left undisturbed for several months, during which time it ages and mellows, acquiring the characteristic perique fragrance. For the entire process about 8 months are required from the time of harvest before the tobacco is ready for use.

Both *andullo* and perique are sold as plug tobacco and are used in smoking mixtures.

The Future of Rubber Growing in Colombia*

by RICHARD EVANS SCHULTES
and ALFONSO URIBE H.

During the past 4 years, Colombia has been laying the agronomical foundations to insure success in the cultivation of *Hevea brasiliensis* for the production of rubber. Probably few Colombian plant industries have counted upon such solid agronomical foundations as the newly born rubber industry now has. At present, the young plantations in Colombia can serve as a center for a gradual and constant development of an industry which could be of great importance in the colonization and agricultural economy of Colombia.

It is unfortunate that some persons view the future of rubber culture in Colombia with fear and pessimism. This is largely the result of misinformation, of which we have suffered a great flood concerning all angles of the rubber problem. Incomplete understanding of the facts and the presumption that normal conditions would be reestablished at the end of the war in the countries which formerly produced almost all the world's rubber have led many persons toward conclusions which, so far as rubber is concerned, are unfounded and wrong.

Superior Geographic Position

The entire Pacific coast of Colombia is humid and tropical, with many regions appropriate for rubber cultivation. The locality where the chief nurseries are situated—the zone of Urabá and in Villa Arteaga—offers excellent geographic advantages.

For may years to come, the rubber production of the Colombian plantations will doubtless go to the industrial centers of the country to supply the numerous rubber and tire factories of Colombia. The "Road to the Sea" will serve to transport this rubber from Urabá to Medellín, Bogotá, and Cali. Forming part of the Inter-American Highway, this road will be finished in a few years, assuring an easy and cheap outlet for the rubber.

Every year, the plantations will produce a greater quantity of rubber, because the trees are maturing toward peak production. When production exceeds domestic consumption, the importance of the location of the Urabá plantations and the geographical advantages of Colombia for exportation to foreign markets will be appreciated. The Gulf of Urabá is a navigable bay of the ocean. The distance from Urabá to the United States is relatively short. Thus, Colombia has an advantage not enjoyed by regions which cannot plant rubber so near the sea and which are situated much farther from North America.

Advantageous System Of Small Family Farms

With admirable foresight, the Colombian Government plans to favor rubber growing amongst small farmers in family gardens. The plantations established in Urabá for the production of rubber are designed to serve also as demonstration centers and for distribution of agronomically outstanding materia

Rubber production at low cost from high-yielding plantations must never be confused with the expensive and uneconomic wild industry which demands primitive methods, such as smoking latex into balls.

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*An expanded form of this article entitled "Razones Que Aseguran el Porvenir de la Industria Cauchera Colombiana" appeared in *Agricultura Tropical* 3, No. 2 (1947).

Typical scene in the jungle of Colombia's Urabá region on the Imamadó River about 1 mile from the base of the foothills.

to all interested settlers. In the future, each of these central plantations should be surrounded by small family plantings of rubber.

The small family farm can be one of the most solid foundations for success of the Colombian rubber industry. This is no theoretical consideration. In the early days of the industry in the Far East, almost the entire production came from extensive plantations, but it was not long before production of rubber in small plantations was shown to be prudent economy. Fifty percent of the world production in the last years before the war came from more than 1,000,000 native gardens, whose individual dimensions varied from an average of 1 acre in Java to a little more than 6 acres in Malay. The tendency in the Far East before the Japanese invasions was to improve the quality of plant material and production methods used by these small farmers. Naturally, the settler planted various crops at the same time: Rubber, barbasco, abacá, and oil palm; and rice, sugar, corn, and cattle on a reduced scale. Thus he insured himself against a temporary drop in the price of rubber or of any other crop.

The advantages to national economy of encouraging small family farms are at once evident. The settler in Colombia is highly individualistic and will work with much more interest on his own farm than on plantations of a large company. Working on his own farm, he does not watch the clock; nor does he observe holidays if there be an urgent need to save a harvest. Furthermore, the small family farm does not have the administration and maintenance costs of a great plantation. This means that, during production, the over-all costs are much less and that, during possible periods when it would not be economically wise to tap rubber, the small farmer can leave his trees without loss, and even with eventual advantages to yield. Also, the small farmer uses the members of his family as workers and employs few outsiders. Thus he is not subject to social laws and other expenses which a large company can never avoid.

Clonal Material Planted Exclusively

Colombia today has the benefit of all the agronomical progress in the science of rubber of the last half century. The Latin American plantations are being planted 100 percent with improved clonal material. A large percentage of the 8,000,000 acres of Far Eastern plantations is of unimproved seed origin. Probably only 10 percent is of clonal origin.

The great importance of this is easy to see. On 1 acre, supporting up to 100 trees, planted with rootstock budded with high-yielding clones, production will be enormously higher than on 1 acre with the same number of trees planted from unselected seed. A tree of clonal origin is the result of grafting a bud from stock of a tree of proved high yield. This represents a vegetative multiplication to propagate the characteristic of high yield *ad infinitum*. On the contrary, in 1 acre of seed trees, there is a highly heterogeneous population with the greater number of individuals of ordinary yield. This means that the total area of Colombian plantings will produce much more rubber per acre than the oriental plantations.

Betterment of Clonal Material

Simultaneously with the work of starting plantations, the project in Latin America includes an intensive search in the Amazon Valley for promising material of *Hevea* species for use in improving the best of our commercial clones.

The first and perhaps the most urgent objective of this program is a search for material of high resistance to the leaf blight which has caused such devastation in various parts of South America, including the early Urabá plantings. The clones of high yield in latex coming from the Far East are not resistant. There, the absence of disease made unnecessary the creation

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Dr. Richard Evans Schultes, Division of Rubber Plant Investigations, U. S. Department of Agriculture, has been working in the Amazon regions of Colombia for the past 5½ years. Ing. Agron. Alfonso Uribe H., Colombia Ministry of National Economy, has been active in his country's rubber program.

of resistant clones. In this hemisphere, where the disease is widespread, and where the few unattacked regions have no hope of escaping for long, we must search for clones combining resistance with high yield; or, until this is attained, using the double bud: Budding the first clone (A) of high yield on a root; then later budding on the trunk of clone (A) another clone with a resistant crown (B), which is usually called the "top bud." The resulting tree is composed of parts of three different trees.

In 1876, Wickham took from the Tapajóz in Brazil about 70,000 seeds of *Hevea brasiliensis*. The enormous rubber industry of the Far East was started with the 2,000 of these which germinated. These seeds came from a few original trees in one small area; they did not represent a sample of the many biological variations of the species.

Naturally, selection carried out with such limited original material had its limitations. However, by continuous selection, hybridization, and other procedures, the British and Dutch have created valuable clones, which are at present almost exclusively used. In one period of slightly more than 10 years, for example, the use of modern technique increased production from 500 to 1,000 pounds an acre. Today, there are clones which yield at least 1,500 pounds an acre.

If so much improvement can be attained by starting with such limited original stock, can we not expect much more improvement with the best material of a vaster extent of the Amazon as a start?

Crown-budding is one solution of the disease problem. But we shall continue investigating until top-budding is unnecessary and until clones richer and better than those of the present are found.

A detailed inspection of the jungles has, therefore, been started. Activities were concentrated in regions of apparent superiority in quality and quantity of latex as well as in resistance, and a rigorous selection of superior individuals of the forest trees was carried out. Botanists in Colombia, Brazil, and Peru have been examining thousands of trees in production in the jungle during the past 3½ years. In Colombia alone, more than 10,000 individuals have been studied, from which more than 200 trees of high yield and apparent resistance have been selected for experimentation. The *Hevea* population of highest resistance known in the Amazon has been discovered in the Leticia area of Colombia. In Peru, clones have been selected which yield fantastically in the forest. It is probable that this phase of the program will supply clones of much greater yield than the best now in use. Furthermore, when these clones are established, they can still be improved by breeding.

The delightful town of Leticia, Colombia's only port on the Amazon, has been an important point in jungle exploration for better trees of *Hevea brasiliensis*.

Packing budwood sticks for shipment from the jungle, Amazonas, Colombia.

We have thus taken the first step toward further improvement of yield in the rubber industry, and, with time, clones may be produced much richer than we have dared to hope for. And the explorations still continue.

Each selection made in the forest has to be submitted to rigorous experiments in the nursery to assure that it will keep its resistance and high level of yield. Already clones have been found which, in their wild state, give more latex than do commercial clones.

Increase in Demand For Natural Rubber

The world has recently passed through a period of acute scarcity of rubber resulting from the war in the Far East. Normal peaceful conditions in the plantation countries have not yet been reestablished.

Before the war, the world consumption of rubber was more than 1,000,000 tons, 800,000 of which were used in the United States alone. The plantations of the Far East, with a total of more than 8,000,000 acres could, under the same conditions that prevailed formerly, produce about 1,500,000 tons a year. During the past 5 years, however, the applications for rubber have multiplied. In many parts of the world, especially in Latin America, new roads have been built, creating a greater demand for motor cars, trucks, and tires.

It is probable that, after the extraordinary demands created during these 5 years of scarcity of rubber have been satisfied, 1,500,000 tons a year will be needed. The demand for tires will increase each year. A tire made before the war had an average of a little more than 13 pounds of actual rubber, and 75 percent of the rubber manufactured in the United States went into tires and tubes.

The great increase in highways, which undoubtedly will continue on a greater scale when heavy machinery is available, safeguards a market for the rubber produced in the countries of this hemisphere. It is expected that, in the future, tires for local consumption will usually be made in the countries where the market exists.

Need for Natural Rubber

The erroneous idea that so-called synthetic rubber can wholly replace natural rubber is inclined to cause a lack of interest in the urgency of procuring this product. There is no synthetic rubber. The various substances which are commonly so-called are artificial substitutes. Natural rubber has not yet been synthesized, and it appears that much more research will be needed before true rubber can be synthesized.

The synthetics now in production are chemically completely distinct from natural rubber. In some applications, as, for example, in the manufacture of tubes for oil conduction and of objects which come into contact with petroleum products, some synthetics are superior to natural rubber. In its first official report the Inter-Agency Policy Committee on Rubber, established by the United States, stated: "Synthetic rubber is not yet good enough for exclusive use in such products as truck tires, airplane tires, and certain medical supplies."

With the scarcity of natural rubber that the Allies experienced during the war, the only recourse was to make tires of rubber substitutes, and success in making large quantities of the product was outstanding. But once the supply of natural rubber becomes normal, the value of the two products will be weighed according to their very different characteristics. The best indication that the future of natural rubber in tire making is assured is the fact that the Firestone and Goodyear Companies are at present forming plantations in Liberia and Costa Rica, respectively.

Intensified work for the establishment of a Colombian rubber industry, therefore, seems highly justified. The opportunity of making Colombia a producer of one of the articles most essential to world progress should not be lost.

Rural Education in the Andes

by LLOYD H. HUGHES

A recent, spectacular educational development in South America is the rural-education program. First inaugurated in Bolivia during 1945, it has since encompassed the Bolivian *altiplano* and moved northwestward into the high plateau areas of Peru and Ecuador. In essence, the development is an adaptation of the community school program, as it is known in Mexico and the United States.*

The program involves the establishment of firm ties between the school and the community, the study of community problems by the pupils, and the assumption of leadership in the solution of community problems by the school. It developed originally as a part of the Cooperative Educational Program participated in jointly by the Bolivian Ministry of Education and the Inter-American Educational Foundation.

The Program in Bolivia

The first step in Bolivia was a complete, functional analysis in 1945 of the country's existing system of rural education. This analysis was made by Ernest E. Maes, special representative of the Inter-American Educational Foundation* in Bolivia, in compliance with the provisions of the cooperative educational agreement signed by the Minister of Education and the President of the Foundation on September 7, 1944.

The study by Mr. Maes brought to light the following data:

(1) A distinction was made between rural education and Indian education on the grounds that the methods employed in teaching the Indians ought to be different from those used in rural schools. The distinction was not based on the racial character of the students but on the prevailing point of view that

Sectional school near Puno, Peru.

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*A community school is one that operates as a full-time educational center for adults, as well as children; utilizes the resources of the community to invigorate the curriculum, which should be based on an analysis of community organization, structure, processes, and problems; improves the community through participation in its activities; and coordinates the entire educational effort of the community.

*See "The Inter-American Educational Foundation and Its Program," by Lloyd H. Hughes in the November 1946 issue of *Agriculture in the Americas.*

Indian education should be generally less formal and less academic. Inasmuch as the Ministry of Education had decided to make all rural education functional and practical, this distinction became meaningless and artificial.

(2) Rural education operated as a dual system, composed of rural schools under the supervision of the chiefs of departmental school districts and *núcleos escolares campesinos* (rural school centers) under the supervision of the Department of Indian Affairs. These *núcleos* consist of a number of small schools grouped around a large central school. The central schools are located in the larger towns, and the smaller schools are scattered among the Quechua, Aymara, and Guarani villages. In the central schools the children are taught to read and write in their native tongue and in Spanish; they are trained in a trade and in scientific farming. In the outlying schools an effort is made to relate education to community needs and to raise the local standard of living.

(3) The rural school centers provide a mechanism through which the essential supervision needed by rural teachers can be given at a minimum cost and with the minimum of personnel. They were found to be better adapted to the social and geographic conditions of Bolivia than the unitary rural schools. The only rural school teachers who were receiving adequate supervision were those attached to the *núcleos*. The regular teachers, numbering nearly 2,000 and representing nearly 85 percent of all rural teachers, received very little supervision.

Class for supervisors of agricultural education at the Granja Salcedo, near Puno, Peru.

(4) The curriculum of the rural schools, including the *núcleos*, was formal and traditional. It stressed academic subjects and literary training rather than practical subjects and training for more efficient production and better living. A completely revised and reoriented curriculum was necessary if the schools were to contribute their just share toward the solution of basic community problems.

Plan for Reorganization of Rural Education

With the information provided by this analysis as a framework, a reorganization of rural education was worked out jointly by the Foundation and the Ministry of Education. The reorganized plan provided for: (1) The abolition of the dual system of rural education; (2) the development of a functional curriculum; (3) expansion of the normal-school program; (4) the creation of a cultural service for rural areas; (5) the preparation and importation of better teaching materials; (6) studies of the Aymara and Quechua communities of the *altiplano* and valleys; (7) salary increases for teachers and supervisory personnel; and (8) cooperation with the Ministries of Agriculture and Health, the Bolivian Development Corporation, and the Institute of Inter-American Affairs.

The first step in the program of reorganization was the merging of the two rural school systems already described and the development of a new system based on the *núcleos escolares campesinos*. To the 17 already existing, 24 new *núcleos* (constellations of central and sectional schools) were added, one to each of the 4 rural normal schools and 20 to replace the abandoned unitary rural schools. As a result, there are today 41 rural school constellations, which are scattered throughout every region and cultural area in Bolivia. All the unitary rural schools have been converted into sectional schools dependent on one of the 41 central schools.

In order to have a more functional type of education, the Minister of Education named a committee to study and revise the rural curriculum. The committee included seven educators from within and without the Ministry. It was known as "The National Committee for the Study of the Rural Curriculum." The first activity of the committee was the development of interest on the part of rural teachers in the preparation of a functional curriculum. This was done through an essay contest open only to rural

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teachers on the subject: "How can the rural-education curriculum be reoriented to better serve the needs of Bolivia's rural population?" The contest was participated in by 211 teachers from every region in Bolivia, and the four winners are now in La Paz working with the committee on the new rural-education curriculum. This plan was adopted, because it was felt that the curriculum should be created by the teachers themselves and not by the Ministry.

A fourth year was added to the rural normal course to ensure that each prospective teacher received training in a practical functional field. In the case of men, this practical training emphasizes agriculture and animal husbandry and, in the case of women, in-home visiting and social service. All fourth-year men students in the future will attend the Rural Normal School at Vacas, where sufficient land is available for the work in agriculture; and all fourth-year women will attend the school at Santiago de Huata. The other two rural normal schools, at Portachuelo and Kanasmoro, will offer the regular 3-year courses.

In order to get the personnel to carry out this program, special training courses were given to two selected groups of rural teachers, one of which is specializing in agricultural education and the other in health education. Thirty teachers were included in the health-education group and 20 in the agricultural group. On the completion of their training courses, each of these teachers was assigned as a supervisor to one of the central schools.

Other Cultural Services

A Cultural Service for Rural Areas has been organized in the Department of Culture of the Ministry of Education. It includes a traveling theater capable of producing and presenting educational plays in the fields of health, child care, agriculture, and civics. In addition, it provides for the showing of educational films throughout the rural areas and for the preparation and presentation of educational materials by radio. This service began its work in the field in January 1946, with a campaign designed to teach the importance of vaccination and sanitation.

In order to relate this reform to the activities of other agencies that deal with rural life, the Ministry of Education has effected cooperative agreements with the Ministries of Health and Agriculture, the Bolivian Development Corporation, and the Cooperative Inter-American Health Service. These agencies cooperated in the training of the two troups of teachers of agriculture and health already mentioned, in the campaign of the Rural Cultural Service, and in the development of the teacher-training programs at Vacas and Santiago de Huata.

Joint Peru-Bolivia Program for Lake Titicaca Basin

In a recent move to improve educational facilities in the basin of Lake Titicaca, the Ministries of Education of Peru and Bolivia in collaboration with the Inter-American Educational Foundation have extended the Bolivian program to this region. This marks the first step on the part of these two countries in cooperatively developing an educational system for a distinct and separate ethnic and cultural region that straddles the border of the two countries.

With the idea of providing a uniform education system for this distinct Aymara area, Bolivia and Peru, on November 1, 1945, signed a convention providing for the establishment of a joint educational program in the basin.* In order to develop a curriculum for the schools of this area, and to put the convention into effect, a second conference of rural teachers of the two countries met in Huarisata, Bolivia, December 19–24, 1945.

Vaccination campaign at typical sectional school in Bolivia.

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*The idea for cooperation between the two countries for a joint program for the basin of Lake Titicaca originated with President José Luis Bustamanta Rivero of Peru while he was Peruvian Ambassador in Bolivia.

Nutritionist feeding Indian boy of southern Peru.

At this conference, it was agreed to adopt the *núcleos escolares campesinos* as the type of school for the basin, because it was best adapted to the social, geographic, and cultural conditions of the region. It was also agreed that instruction should begin in the native language of the pupils but should shift to Spanish as soon as practicable.

The preparation of common textbooks in reading, writing, agriculture, and health was strongly recommended, and a complete course of instruction for children between the ages of 4 and 14 was prepared. This was divided into four levels or cycles as follows: (1) Kindergarten for children of 4 to 6 years; (2) preparatory instruction, 6 to 7; (3) elementary, 7 to 12; and (4) complementary and prevocational instruction, 12 to 14.

A selected group of Bolivian and Peruvian teachers attended a training course between July and December 1946 at Puno in southern Peru and received instruction that prepared them to be supervisory teachers in the *núcleos escolares campesinos*. Specialists in rural education, health, home economics, nutrition, and agricultural education, supplied by the Ministries of Education of Bolivia and Peru and the Inter-American Educational Foundation, were in charge of the training course. Seventeen Bolivians and 40 Peruvians enrolled in the course.

The success of this rural-education development in Bolivia and the Lake Titicaca Basin has led to the extension of the nuclear or constellation type of rural schools to the other Indian-speaking areas of Peru and Ecuador. It has attracted the attention of the Inter-American Indian Institute, which has requested Ernest E. Maes to attend its Conference on Indian Life at Cuzco in November 1947 and to lead a discussion centered on this new development in rural education.

Benefits of New System to the Children

First of all, the adoption of this type of rural education has meant the extension of educational facilities into many hitherto neglected rural regions of the Andean *altiplano*. In 1945, the latest year for which statistics are available, over 1,500,000 children of school age in this area were not attending school, mostly because schools and teachers were not available. Through the new program many new rural schools have already been established, and others will be opened each succeeding year.

The conditions of health in the rural areas are being improved. All children attending nuclear schools are being vaccinated for smallpox and inoculated for typhus and other preventable diseases. Health teachers are not only teaching better health practices to the children but are also working with the parents to see that these practices are carried on in the homes. Because many of the pupils walk long distances to school without breakfast, the teachers are now providing hot, nutritious breakfasts, as well as lunches, for them. In this way the children are assured at least two balanced meals a day.

Through the workshop program and normal courses already completed, many rural teachers have been trained and are now at work in the central rural schools. As more are trained, the educational horizons of the children of the Andean *altiplano* will be greatly extended.

Other advantages to these children, resulting from the new program, are better school buildings, more and better instructional materials, a more functional curriculum, and opportunities for cultural contacts outside their native communities.

Fuel Without Trees

In treeless areas the securing of fuel sometimes poses a problem. A dome-shaped plant known as yareta, growing in high Andean regions, makes an excellent substitute for wood, coal, or other materials used for power and heat.

by HUGO W. ALBERTS

Growing in the high mountain regions of southern Peru, as well as in Bolivia and Chile, is a curious plant, yareta, which is rich in resinous substance and serves for fuel in mines, bakeries, and railroad locomotives. It grows in a clump, sometimes as much as 12 feet in diameter and 3 or 4 feet in height. Each plant resembles in appearance a flattened dome-shaped honeycomb or a multiple head of cauliflower. It is bright green when growing, but it turns to an earth color when dried. A field of yareta in the rainy season looks as if it were covered with green moss.

Yareta, known botanically as *Azorella yarita*, forms dense masses of many-forked stems, which group together strongly in the form of a conglomerate tumor. Each stem terminates in an inflorescence, the seeds of which are yellow, contrasting with the green surface of the plant.

During the rainy summer months the brilliant green fields of yareta absorb the water of the mountain seepage, giving the land a spongy aspect. When one walks on the area, it resounds as if caves were under the surface. In the dry winter season, when the temperature drops to several degrees below freezing, the spongy mass dries. This causes contraction, accompanied by great pressure, which aids the lignification of the mass of stems.

Handled Like Peat

During the dry season, from April to December, yareta is dug. The entire plant is taken out whole if it is not more than 1 to 2 feet in diameter. If larger, it is taken out in pieces. The unbroken plant is cone-shaped, ending in a single stem at the bottom. The numerous branching stems above are closely fitted together to give a honeycombed appearance. The plants and pieces, as dug, are piled at convenient places along a highway or railroad and left to dry until picked up later. The resinous substance which oozes from the mass during this process has astringent and absorbent properties, and the native people use it as a remedy for wounds.

When the piles of dried yareta are picked up, they are transported to consuming centers. Since the material is light, comparatively large volumes can be transported with ease. It burns with little or no smoke and produces an intense heat. The average calorific value is reported to be 5,000, with 41 percent carbon, 48 percent volatile matter, and 4 percent water. It can be burned in the green state, but then it has a lower fuel value. A plant which may develop approximately 4,700 calories in the green state will develop over 5,300 calories after 3 months of drying.

Although the chief uses of yareta are in bakeries, mines, and railroad locomotives, the Indians who live in the region where it grows use it as fuel in their homes. The ashes are valued as fertilizer. One mining company in the Department of Puno is reported to have paid for yareta 26.50 soles per metric ton, or the equivalent of 18.5 cents (U. S.) per 100 pounds. This fuel is used in the locomotives running from Arequipa to La Paz, from Arica to Tacna, and to some extent in those from Puno to Cuzco.

A curious plant, yareta, growing in high Andean regions, makes an excellent fuel.

Hugo W. Alberts is Agricultural Adviser at the American Embassy, Lima, Peru.

Yareta thrives best at altitudes of from 12,000 to 16,000 feet above sea level, in canyons protected against winds of the *puna* or high mountain prairies. It is found almost entirely on slopes facing the east, where the morning sun strikes, and in canyons containing many stones which afford it protection.

The plants are propagated by seeds disseminated by wind. They grow in areas where the temperature at times may be as low as 4° Fahrenheit below zero. Sometimes the areas on which they grow are covered with snow for periods of several days.

The Departments of Tacna, Moquegua, Puno, and Arequipa contain the principal growing areas of Peru. The largest area is between Puno and Tarata, near the Chilean border, consisting probably of nearly 1,250,000 acres. One concession alone works 123,550 acres. Where the stand is thick, the average yield is approximately 4 tons an acre. Plants are frequently dispersed in patches over wide areas. A good *yaretal* or producing area has 10 to 15 percent of the surface of the ground covered with plants.

The vegetative life of this plant is virtually undetermined. Apparently, under the best management, all the usable plants are taken out of the *yaretales* (growing areas) at one time. The small plants are then left to develop undisturbed. As a conservation measure, a resolution of the Peruvian Government, dated April 18, 1942, declared that the yareta zones of Peru were reserved by the state and placed under the jurisdiction of the *Ministerio de Fomento y Obras Públicas*. Exploitation of the *yaretales* is authorized under the following rules: (1) Applications for exploitation must be presented to the *Dirección de Tierra y Montana y Colonización*, accompanied by a plan of the area to be exploited drawn to a scale of 1 to 50,000; (2) applicants must pay 10 centavos per hectare for the area on which they expect to operate as a guaranty that they will fulfill their contracts.

Beginning with 1940, a considerable quantity of yareta has been exported, especially to Chile. In 1942, nearly 6 million pounds went to Chile and more than 550,000 pounds to Bolivia.

The yareta near the railroads and highways has been utilized, and it is now necessary to go considerable distances to find supplies in large quantities. Unless further measures are provided and enforced to regulate exploitation so that areas from which a crop has been taken will be left in a condition for a new crop to succeed, it will not be many years before the supply is exhausted.

High in the treeless regions of the Andes grows the yareta plant to serve as a substitute for wood, coal, and other fuels in bakeries, locomotives, and even in the homes of the Indians.

ALONG THE *Agricultural Front*

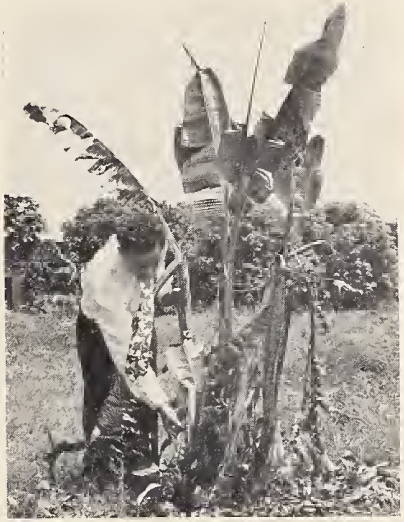
▲ Rayadilla Threatens Colombia's Bananas

The staff at the Estación Agrícola Experimental de Palmira, Colombia, has girded itself for a fight against an unidentified enemy—a disease which threatens the banana plantations in the Cauca Valley. The disease attacks all members of the Musaceae family—bananas, plantains, abacá, and even the traveler's tree.

First noted about 1941 in a plantation of plantains near the town of Florida, the unknown enemy virtually demolished the entire planting of approximately 175 acres, and few plantations in the Cauca Valley have to date escaped unscathed.

The devastating disease, known locally as *rayadilla*, is characterized by the appearance of yellow streaks in the top leaves of a plant. Thereafter the affected leaves begin to curl up and gradually dry out from the edges inward. New shoots decay on the tips and develop in a stunted fashion. Bunches of fruit do not turn downward and have the appearance of being affected by the so-called "bunchy top" disease.

In studies, first conducted at Palmira in 1943 and 1944 by Dr. Enrique de Rojas Peña and Ernesto Mariño M., it was assumed that rayadilla was caused by bacteria. Subsequent studies by Ricardo Cardenosa, present head of the plant-pathology department of the station, have resulted in the tentative conclusion that the causative agent is a virus. Experiments to test both theories are now in progress.


New shoots are developing abnormally in the heart of this plantain, which is affected by rayadilla.

Bacteria isolated from infected plants have been injected into new leaves of healthy plantains, aged 2, 3, and 4 months. Inoculations have also been made in the root systems. Results so far have been negative. Efforts have also been made, so far unsuccessfully, to isolate the possible virus agent; and some preliminary observations have been made with respect to the effect of soil fertility on the disease. On good land, the yellow streaks appear less pronounced, but on diseased plants, the fruit is small and poor in quality. Various fertilizer applications are being tried in an attempt to reach some definite conclusions as to the part played by soil conditions.

Rayadilla threatens the economy of the Cauca Valley on two fronts. On one, it has caused a scarcity of bananas and plantains, with a consequent jump in prices; on the other, it endangers the cacao industry, for plantains have long been intercropped with cacao to provide the shade so necessary in the production of the lucrative cocoa or chocolate bean.

▲Chile Puffs Its Cereals

For the first time, puffed rice, wheat, corn, and oats, made at home, are appearing in Chilean markets. They are the output of a new manufacturing industry, reported to have been successfully started by a former Chilean diplomat. He became interested in the "puffed" type of cereal breakfast foods while sojourning in the United States. Here he acquired the know-how, as well as the necessary machinery and equipment, for his enterprise.

▲ Panama Needs More Farm Machinery

The wartime shortage of food products in Panama has focused interest on agricultural development in the Republic. Through the support of the Ministry of Agriculture and Commerce the demand for and use of farm machinery and implements other than tractors have been steadily growing, although no information is available as to the annual utilization of such equipment by types. Part of the increased demand is attributed to the prevailing higher cost of living and the higher wages paid which have prohibited the use of manual labor in agricultural enterprises.

Practically all the farm machinery and equipment used in Panama is imported from the United States. About 90 percent of future imports will probably be made through governmental channels.

Reading about the AMERICAS

Chemical Specialties, compiled by H. Bennett. 826 pp., illus. Chemical Publishing Company, Inc., Brooklyn, N. Y., 1946. This symposium was compiled to serve as a guide to all those interested in building up a chemical specialty business. The compiler states that "its purpose is to teach the elements of chemistry to the businessman and give the necessary business information to the chemist." Six chapters deal with chemistry, chemicals, raw materials, processing procedure and equipment, and the formulas to be used in manufacturing various commercial products. Then follows a discussion of marketing techniques and general business principles. The records, forms, and technical helps needed in a chemical specialty business are illustrated or described. Federal laws and regulations relating to chemical specialties are cited, with the admonition that, since local and State laws vary, they should be ascertained for the locality chosen before starting in business. Other valuable information regarding chemicals and chemical supplies is given in the appendix.

Commercial Possibilities of the Forests of Ecuador—Mainly Esmeraldas Province, by M. Acosta Solís. 47 pp., illus. Reprint from *Tropical Woods*, No. 89, March 1, 1947. After a short geographic description of Ecuador and a summary of the country's agriculture, the author takes up the forested areas of Ecuador by regions. He discusses forest exploitation in the country and the economics of its forest products. The industrial possibilities of a forest industry and areas suitable for immediate exploitation, together with local factors related to such an enterprise and an alphabetical check list of the principal forest species of Ecuador, complete the discussion.

Santa Eulalia: The Religion of a Cuchumatán Indian Town, by Oliver LaFarge. 211 pp., illus. The University of Chicago Press, Chicago, Ill., 1947. This is an ethnological study made in the area known as Los Altos Cuchumatanes—The Heights of Cuchumatín—in the Department of Huehuetenango, Guatemala. In it the author presents the greater part of his observations made during a visit to the area in 1932. His investigations related largely to native religion and ceremonial, with a view to determining the surviving remnants of Mayan civilization. The people, living in almost complete isolation from the influence of the outside world, were found to practice a religion which combined the myths and legends of ancient days with symbols and teachings of Christianity, all fused into a whole known only to the initiated. Descriptions of the country and the peoples make fascinating reading for those interested in other folk of other lands and times.

Mexican Heritage. Photographs by Hoyningen-Huene, text by Alfonse Reyes. 136 pp., illus. J. J. Augustin Publishers, New York, 1946. A book of full-page photographs, interpreting Mexico through the "effects of our landscape on the mind." Without sociological dissertations or economic statistics, even without captions (these are listed together in the back of the book), the pictures give an understanding of a people. A brief poetically phrased prose text introduces each of the three divisions of the book: The records left in stone through the centuries; the plants, trees, landscapes, and highland scenes of Anáhuac, the extensive plateau of Central Mexico; man's attempts through the years to symbolize in the architecture and religion of this New World his eternal dream of and search for Utopia.

Climatología de Mexico, by Jorge A. Vivó and José C. Gómez. 77 pp. Instituto Panamericano de Geografía e Historia; Dirección de Geografía, Meteorología e Hidrología, Publicación No. 19, Mexico, D. F., 1946. This publication, which is composed largely of maps and charts, records the results of investigations in climatology extending over several years. There are four parts: Termodinámica; Fenómenos acuosos; Ciclones, anticiclones, masas de aire y frentes; Climatología.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS HALLY H. CONRAD, EDITOR

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Gifts of the Americas

THE SWEETPOTATO

by CONSTANCE H. FARNWORTH

The *camote* or *patata* of tropical America, better known to us as the sweetpotato (*Ipomoea batatas*), is often thought of as the queen of all root crops. It is grown in abundance everywhere throughout the Tropics and subtropics and also in some parts of the Temperate Zone. In the United States successful cultivation has extended as far north as central Illinois and New Jersey.

America is believed to be the original home of the sweetpotato. Columbus found the crop being grown by the Indians in Cuba, and later Spanish expeditions found it growing in Mexico and South America. The sweetpotato was carried early to Spain and spread over all of Europe, being introduced into England long before the Irish potato. It has been a favorite in the United States for a long time. General belief is that the early settlers of Virginia were cultivating and using it as a food about 1610.

The sweetpotato belongs to the Convolvulaceae or Morning Glory family. It is a perennial, bearing white, yellow, or purple blossoms somewhat the shape of a morning glory, but under cultivation it is treated as an annual and seldom blooms. The leaves vary in size and shape. The stems are long and trailing, about 6 to 8 feet in length, and lie prostrate on the ground, sending out roots from the nodes that touch the soil. Sweetpotatoes develop on these roots as well as on the original root.

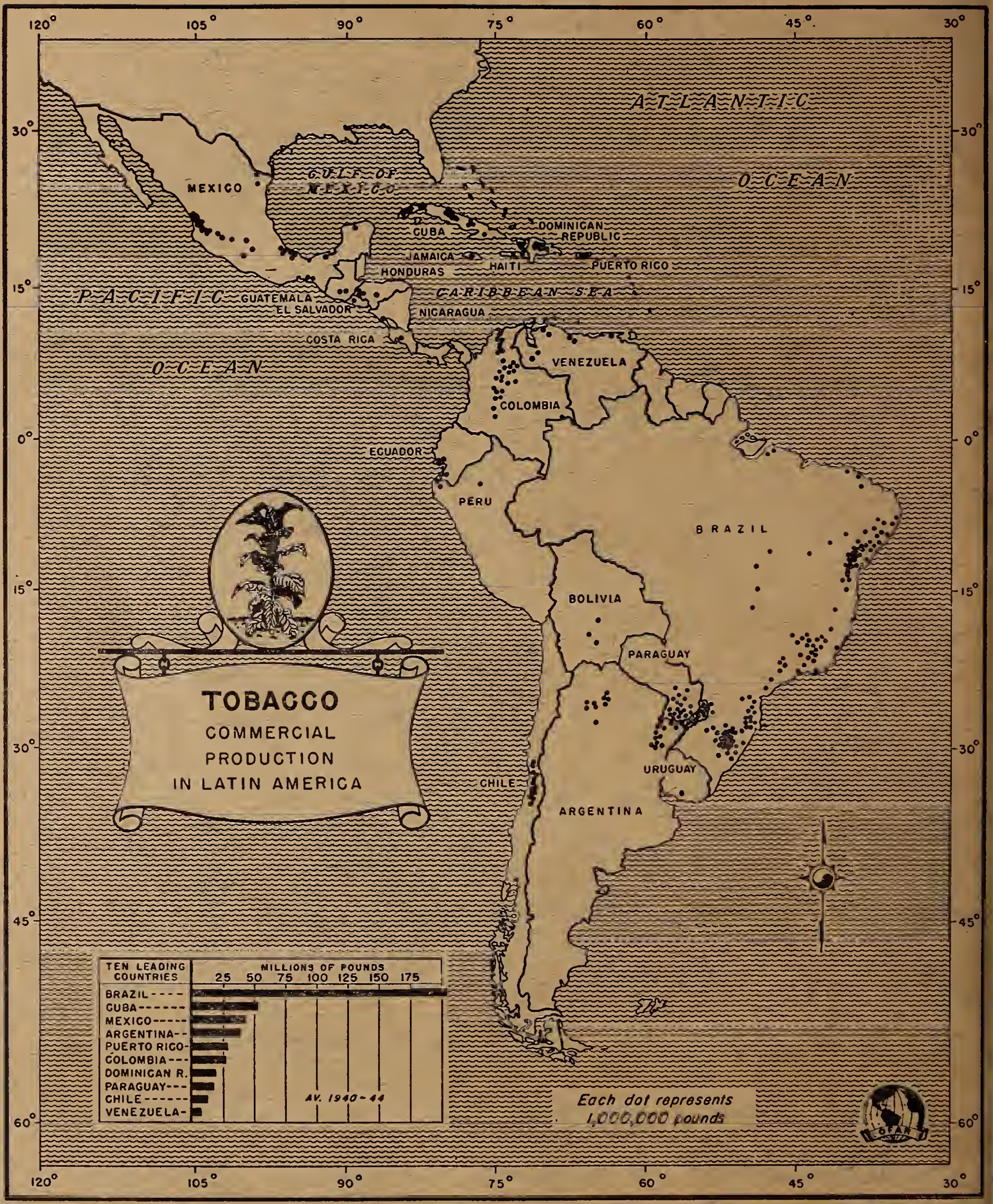
There are several varieties of this vegetable now in production, ranging in size from a few ounces to several pounds, and with purple, yellow, or white flesh. Some varieties are dry and floury when cooked, such as the *ahoga-perro*, meaning dog-choker, in Puerto Rico. These dry mealy potatoes are the Jersey type and are preferred in the northern markets of the United States. Other varieties, such as the Nancy Hall and Southern Queen, are mushy and sweet when cooked, and these are preferred in the Southern States. Sweetpotatoes are often confused with yams because of the resemblance between the two vegetables, but the yam belongs to another genus of plants, the *Dioscorea*.

Areas with an abundance of sunshine and warm weather, a reasonable amount of moisture during the growing season, and a light, well-drained sandy-loam soil with a clayey subsoil are ideal for growing sweetpotatoes. Our Southern States, with their warm climate, produce about 90 percent of the total United States crop, which in 1945 was approximately 67 million bushels. In tropical countries production continues throughout the year.

Propagation is carried on by vine cuttings or by slips from plant beds. When vine cuttings are used, they are set into shallow hills or ridges or on the flat ground either by hand or with machines. Plowing should not be too deep, because deep soils tend to produce long, stringy potatoes. Otherwise the plant requires little care, growing almost as a weed in some tropical areas. In the western tropics, vine cuttings which have been merely kicked into unplowed ground and seldom hoed or weeded have been known to grow, even though they may earlier have been rolled in banana leaves and carried for several days, half baked by the sun, on the back of a patient plodding burro. Because of the hardiness and simple cultural requirements of the plant, it probably is neglected by many producers. Better care undoubtedly would increase the yields and quality of production.

The chief use of the sweetpotato is for human food, but it is also fed to livestock and may be used for making starch, sirup, and alcohol. In the American tropics it is a staple part of the diet, and almost every home has its sweetpotato field. Large quantities in the United States are preserved by canning. Some of the more popular ways of serving sweetpotatoes as food are: Glazed, as filling for pie, escalloped, boiled, broiled, roasted, and as *rechauffe* of cold sweetpotato. In most countries only the roots are used as food, but in the Philippines the tender shoots are considered excellent for greens.

The sweetpotato is preferred to many other root crops because of its wholesomeness and delicacy. At the same time, it is a valuable source of pro-vitamin A, thiamine, riboflavin, calcium, magnesium, potassium, sodium, fats, protein, sulfur, and iron. It is rated about equal to the tomato as a source of vitamin C, and it surpasses even the white potato as a source of carbohydrates.



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NAMES & NEWS

Claud Horn Reports On Cacao Conference

Claud L. Horn, Head, Complementary Crops Division, OFAR, on his return from Central America, reported a successful organizing conference of cacao technicians at the Inter-American Institute of Agricultural Sciences in Costa Rica early in October. The following countries were represented: Ecuador, Colombia, Venezuela, Panama, El Salvador, Mexico, Dominican Republic, Costa Rica, and the United States. *Dr. Robert L. Fowler,* Horticulturist, *Estación Agrícola del Ecuador,* Quito, was among those present.

OFAR Consolidates Monthly Publications

This is the last issue of *Agriculture in the Americas,* as such. The magazine is being combined with *Foreign Agriculture,* which is being enlarged to include the type of material formerly appearing in *Agriculture in the Americas.* Subscribers to both *Agriculture in the Americas* and *Foreign Agriculture* will receive the combined publication until further notice.

James Mitchell Goes to Peru

James T. Mitchell, of the Canal Zone Experiment Gardens, has gone to Peru to develop a more efficient organization at the *Estación Central de Colonización en Tingo María* for the dissemination of information to the farmers of eastern Peru.

Dr. Wellman In Cuba for Study

Dr. Frederick H. Wellman, Pathologist, Inter-American Institute of Agricultural Sciences at Turrialba, Costa Rica, during October was temporarily assigned to the fiber project in Cuba to study diseases affecting kenaf.

John Hepler Returns from Peru

John V. Hepler, Head, Extension and Training Division, OFAR, has returned to his post in Washington after spending 2 months in Peru. While there he aided in the organization of extension programs at Tingo María. He also assisted in training local extension workers in program techniques and methods of conducting extension work.

Oscar Moore Goes to Brazil

Oscar K. Moore, formerly an economist in the Office of Foreign Agricultural Relations, has been appointed by the Department of State to the American Consulate at São Paulo, Brazil, as an Agricultural Officer.

Recent Visitors From South America

Among recent visitors to the Office of Foreign Agricultural Relations were *Dr. Luis B. Ortiz,* Director, Agricultural Experiment Station, Medellín, Colombia, who came to this country for a year of study on agricultural cooperatives; *Ing. José A. Pastrena,* Vice Director of the Central Agricultural Zoological Laboratory, Buenos Aires, Argentina, who was sent by his Government for a year of study in the United States on injurious microlepidoptera (some of the smaller moths); and *Sr. Raul Beingolea,* Head, Plant Genetics Department, La Molina Agricultural Experiment Station, Lima, Peru, who came under sponsorship of his Government for the study of plant genetics.

Dr. Winters Makes Brief Visit to OFAR

Dr. N. E. Winters, Director, *Centro Nacional de Agronomía,* El Salvador, made a brief visit to the Office of Foreign Agricultural Relations in the interest of his technical collaboration work at the *Centro* in San Salvador.

Rolland Lorenz Takes New Post in Guatemala

Rolland C. Lorenz late in October assumed his new duties as Director of the *Instituto Agropecuario Nacional* in Guatemala.

Agriculture IN THE *Americas*

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Mulching Tropical Plants

by DAVID G. WHITE

The mulching of plants with leaves or other materials has been found to have definite advantages over clean cultivation or sod culture. While more generally practiced in temperate climates, good results could undoubtedly be obtained under tropical conditions.

The term "mulching," as used in this discussion, means the maintenance of about 6 inches or more of leaves, or similar plant debris, on the soil surface above the major portion of the root system. There are also other types of mulches, such as special paper, which have many but not all the advantages of plant debris. In the United States the mulching of fruit trees is becoming increasingly popular, and an attempt will be made here to show how and when a mulch can be beneficial to tropical farmers.

An important advantage of mulching plants is the conservation of soil moisture. Ordinarily many soils fail to retain sufficient moisture for optimum plant growth during periods of dry weather. This is also true in tropical areas where seasonal heavy rains are followed by definite dry seasons. A high total annual rainfall does not insure adequate soil moisture throughout the year. During a drought, however, soil moisture beneath a good mulch is almost always higher than when the soil is exposed by cultivation or covered with weeds. This was demonstrated at Mayagüez in an experiment with

An experimental field of *Derris elliptica* mulched with sugarcane leaves. This practice resulted in better retention of soil moisture, lower soil temperatures, and less labor for weeding.

Derris elliptica (Wall.) Benth. in which 6 inches of sugarcane leaves were used as a mulch on a Toa silty clay loam. The moisture content 6 inches below the soil surface averaged 22.3 percent after 3 months of dry weather, whereas the moisture content of cultivated plots nearby averaged 17.9 percent. On a moisture basis this represents a difference of nearly 25 percent, which apparently was important, because the mulched plants were considerably more vigorous.

Another benefit obtained from the mulching of plants is the addition of nutrients to the soil. This occurs because the rain leaches various chemicals from the mulch material. Naturally the original amount of nutrients in the mulch itself will determine to a large extent the amount of nutrients added to the soil.

In an apple orchard marked increases in potassium and smaller increases in calcium, magnesium, phosphorus, and boron were found in soil beneath a straw mulch by J. H. Gourley and I. W. Wander at the Ohio Experiment Station. Mulches are probably leached more rapidly in the Tropics than in Ohio because of heavier rainfall and higher mean temperatures. For these same reasons tropical soils are often low in leachable constituents, and the replacement of these from mulches is particularly beneficial to plants.

Mulching Improves Soil Structure

Soil physicists have found that good soil structure occurs when the individual particles are cemented together in small lumps or aggregates. These aggregates are more or less resistant to break-down by water. Thus, water can penetrate a well-aggregated soil more easily than a soil in which the particles are separated and tend to pack, just as water drains through a layer of gravel faster than through a layer of fine sand. One requirement for soil aggregation is the presence of a cement to bind the particles together. In tropical soils, iron oxides often act as a cement, and these can be augmented with humus extracts from a mulch. Thus, a sharp increase in aggregate formation of silt loam soil below a straw, or alfalfa, mulch was demonstrated by Leon Havis at the Ohio Experiment Station. Soils well aggregated not only permit rapid entrance of water but also of air, and good aeration is an important factor favoring root development.

Unrooted cuttings of derris were planted beneath mulches of banana leaves, black tar paper, lemon-grass leaves, and tar paper painted white. The best results were from lemon-grass leaves.

An additional advantage of mulching is the reduction of soil erosion. As mentioned above, mulching results in increased aggregation; as a consequence most of the water penetrates the soil, does not run off the surface, and therefore does not cause erosion. Torrential tropical rains, however, strike exposed soil with considerable impact. On a slight slope the impact of the raindrops mechanically knocks the soil down the slopes. Even a thin layer of leaves markedly reduces this type of erosion, But, better yet, a good mulch of several inches will almost entirely prevent erosion by reducing the rate of water run-off. For example, a planting of bamboo (*Bambusa longispiculata* Gamble ex Brandis) was made on a steep 52-percent slope. Yet within 4 years, 4 inches of accumulated leaves aided in completely controlling erosion. Tropical farmers need to prevent their fertile topsoil from "going down the river." The practice of mulching economic plantings on slopes is part of the answer in many cases.

Mulching reduces the time required for weeding, because a good mulch smothers most of the weeds it covers. As an example, only one-third as many man-hours were necessary to hand-weed plots of derris plants that were mulched with 6 inches of sugarcane leaves as compared with plots that were cultivated. In areas where labor is costly and mulching material cheap this saving in man-hours alone is important. Of course, the cost of obtaining and applying the mulch must be considered, which factors are discussed later.

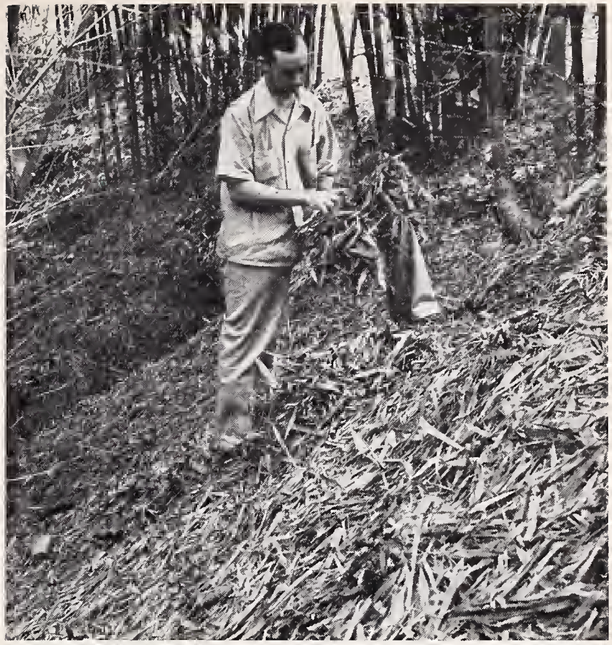
A good mulch results in lower soil temperatures in the Tropics. The temperature of topsoil depends a great deal on absorption of heat from sunlight. Soils which are exposed to the sun become warmer than those which are covered with vegetation or mulch. An example of this difference was measured in a derris-mulching experiment by means of a double-recording soil thermograph. Soil temperatures at depths of 3 and 6 inches on cultivated plots were often 5° to 10° Fahrenheit higher than the highest daytime air temperatures. On the other hand, the highest soil temperatures beneath a mulch were always 5° to 10° lower than the highest air temperatures. When the air temperature was 94° at 3:00 p. m., the soil temperature at a depth of 3 inches in a cultivated plot was 100°. The soil temperature at the same depth in an adjacent plot mulched with 12 inches of lemon grass was only 84°. High soil temperatures, such as those encountered in the cultivated plot, are undoubtedly detrimental to many plants, particularly those with a shallow root system.

Some Disadvantages Of Mulching

In areas with regular, heavy rainfall a mulch may cause too great an accumulation of soil moisture for the best development of some plants. This situation apparently occurs with young cinchona trees in the rainy interior of Puerto Rico, according to observations by H. F. Winters of this station. Some other possible disadvantages of mulching are: The distribution of obnoxious seeds in the mulching material; the fire hazard of dry mulch; and the harboring of mice, snails, insects, and disease organisms detrimental to the economic crop. With regard to pests, however, some crops are not vulnerable to them; in other cases poison baits or sprays are effective controls.

The original application of large quantities of carbonaceous mulch, such as grass, leaves, or straw, often results in a temporary deficiency of available nitrogen in the soil. This phenomenon occurs because bacteria have the first choice of soil nitrogen and utilize it in decomposing the mulch. Where important to the crop, a nitrogenous fertilizer may be applied to compensate for the temporary deficiency.

In some cases the cost of obtaining an adequate supply of mulch may be a real disadvantage. Some orchardists in the temperate regions grow special crops to be harvested solely for mulch. This practice might not pay dividends in the Tropics, where, for one thing, it is necessary to mulch well every 3 to 6 months as compared with once a year in temperate climates. This is necessary, because mulches decompose more rapidly under high moisture and temperature conditions. On the other hand, farmers in the Tropics generally have access to several sources of mulching material 12 months of the year. Aside from proprietory products, such as special mulching paper, tropical farmers can use leaves of debris of sugarcane, lemon grass, citronella grass, bananas, legumes, or a combination of legumes and vigorously growing grass, seaweed, sawdust, wood shavings, bark, and numerous grasses not under cultivation. Trials of odd mulching materials, such as sawdust, should be used on a limited number of plants before attempting a large-scale operation. Sawdust from some trees may contain excessive amounts of tannins which are toxic to some plants, but this is not the usual case.



The accumulation of 4 inches of bamboo leaves beneath *Bambusa longispiculata* helped to prevent erosion on a 52-percent slope.

Farmers in temperate regions often find that fertilization of grasses, in particular, with nitrogen (about 200 pounds of ammonium sulfate, or its equivalent, per acre) more than doubles the amount of mulch which can be removed. This practice also should be worth while in the Tropics.

The advantages of mulching usually far outweigh the disadvantages. It is highly important to maintain the mulch at a depth of at least 6 inches, preferably 10 or 12 inches, throughout the life of the plant. Thin layers of mulch have little value, except to retard the rate of water run-off and consequent soil erosion.

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Ecuador's Naranjilla—A Reluctant Guest

The juice of the "Naranjilla de Quito" would no doubt be relished in the United States. But efforts to make the plant "at home" in this country have so far been unsuccessful.

by LEWIS P. McCANN

A native South American plant, *Solanum quitoense* Lam., which yields a delicious and refreshing fruit juice, has been a source of periodic interest for many years. The conquistadores are believed to have named the plant "naranjilla" because in shape, color, acidity, and other characteristics the fruit is similar to the orange. In Quechua, the ancient Incan language still used by the Andean Indians, the plant is known as "Lulum"; in Peru, it is called "Naranjita de Quito" and in France, "Morelle de Quito." The more general name, "Naranjilla de Quito," is usually shortened to "naranjilla."

The plant in its native habitat is a robust suffrutescent herb 6 to 10 feet high with gigantic pinnately veined leaves 12 to 18 inches long. Abundant spherical-to-oval fruits are produced every month of the year over a period of about 3 years, with peaks of production during February–March and August–September. The fruits when mature are about 2 inches in diameter and bright orange in color. At this time they are covered with a soft pubescence which is easily removed by rubbing. In cross section they are similar to the tomato in general morphology. The pulp of the fruit is green. Seeds are lens-shaped and slightly larger than tomato seeds.

Naranjilla fruit on a plant growing near El Topo, Ecuador.

Flowers are borne in axillary corymbs along the entire stem. The corolla of the flower, about 1.5 inches in diameter, is star-shaped with 5 white petals. The stamens are 5 in number inserted on the corolla and have terminal pores for pollen escape. The flowers are usually perfect, with occasional abortive pistils.

Popenoe, Gattoni, and Chalons* have described the plant and its fruit in detail.

Where Does It Grow?

The Division of Plant Exploration and Introduction of the United States Department of Agriculture has made many attempts to introduce *Solanum quitoense* into cultivation in California, Florida, and other Southern States as a field crop and in many Northern States as a greenhouse crop. So far there has been no report of a successful crop of fruit, though in most cases vegetative growth was good.

In Ecuador about 90 percent of the commercially grown naranjilla fruits are produced in the valley and nearby hillsides of the Pastaza River, an Ecuadoran tributary of the Amazon. The area extends for about 15 miles between the towns of Baños and El Topo. Though most of the commercial production is limited to the Baños-El Topo region, the species range is reported to be in the Andes between the limits of latitude 2° N. and 5° S., longitude 79° and 82° W., at elevations between 3,000 and 7,000 feet.

Other naranjilla-producing areas include San José de Minas, Nanegal, Calacali, and Gualea, all towns

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*Popenoe, Wilson. *Economic Fruit-Bearing Plants of Ecuador.* Bull. U. S. Nat. Museum. May 28, 1924. Gattoni, Luis A. *La Industria del Jugo de Naranjilla Ecuatoriana.* Dirección General de Agricultura del Ecuador. 1935. Chalons, Manuel E. R. *Naranjillas.* Agriculture in the Americas. June 1944.

to the north of Quito, Ecuador. In southern Ecuador the plant is found in the Yunguilla Valley in Azuay Province and in the Guangocolla Valley of Loja Province. On the eastern slope of the eastern range of the Andes, about 50 miles in an air line east of Quito, a different type of naranjilla is found in the vicinity of the town of Baeza. This fruit is less juicy but sweeter than the Baños-El Topo naranjilla.

Outside Ecuador, the naranjilla has been reported growing in the Cauca Valley of Colombia* and in the forests of northeastern Peru. The only report of a successful crop of fruit grown at any great distance from the native habitat of the naranjilla is a note from the Instituto Agropecuario Nacional de Guatemala (*Agriculture in the Americas*, November 1946).

Because of the exacting requirements of the plant for proper growth and fruit production, the failure of the plant to set fruit in the continental United States, the perishable nature of the fruit for shipping, and inadequate canning, bottling, and preserving techniques, the fruit and its juice are relatively unknown in the United States.

Requirements for Growth And Fruit Production

Little is known regarding the ecological requirements of the naranjilla except deductions made from the characteristics of the areas in which the plant grows. Rainfall requirement is high. Annual precipitation records in the Baños-El Topo region range from an average of about 60 inches in Baños to about 150 inches in El Topo. The elevation of Baños is about 6,000 feet, and El Topo lies at 3,000 feet. Rainfall and temperature increase rapidly on the eastward descent from Baños to El Topo and the great Amazon Valley.

Probably, of the critical factors of the tropical Andean climate, one that is difficult to match in northern latitudes is the temperature curve. During the entire year tropical temperatures remain comparatively uniform. Though flushes of growth are noted at certain periods of the year, growth is fairly constant without the dormant periods characteristic in plants growing in Temperate Zones.

Commercial production of the naranjilla fruits is still limited to small parcels of land on a semicultivated basis. The seeds are planted in a nursery bed, and the small seedlings are transplanted to virgin-forest soil under a canopy of trees. Clearing of the land consists in cutting away underbrush with a machete. Plants from the nursery bed are spaced about 6 feet apart and left with no further care except for weeding once or twice during the year.

They usually begin to bear fruit about 10 to 14 months after seeding. When they have been in bearing for about 3 years, the plants are abandoned, and a new plantation site is located.

The selection of virgin soil for each new plantation of naranjillas is practiced customarily, because growers have found from experience that the plant does not thrive on soil that has been used for other crops and especially on soil that has previously been used for naranjillas. Gattoni suggested that the naranjilla might release a self-toxin into the soil. There is also the possibility that certain required minerals are depleted during the growth period of the crop. Commercial fertilizers are relatively unknown in the producing areas, and manures of any description are not readily available or in general use.

Yields and Production Costs

The naranjilla is a prolific producer. In 1938, estimates by Gattoni put the annual yield per hectare

Harvesting naranjillas near Baños, Ecuador.

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*Hodge, W. H. *El Lulo, una fruta Andina poco conocida*, Rev. Facultad Nacional de Agronomía 7(26):147–154, Medellín, Colombia. 1947.

Naranjilla plants, 10 months old, propagated from cuttings, and growing in a greenhouse bench.

(2.5 acres) at about 12,500 gallons of juice, having a value of about $12,000, or about $4,858 per acre. The costs of production over a 3-year period were low. The cost per hectare for clearing, preparation of seedbeds, transplanting, weeding, replanting, pruning, etc., amounted to about $300, or $122 per acre.

Though production costs have undoubtedly risen since 1938, the increase may be partially offset for the potential exporter by the decrease, from 70 to 35 cents per gallon, in the United States import tax on fruit juices containing less than 0.5 percent alcohol.

Greenhouse-Grown Naranjillas

In view of the many desirable qualities of naranjilla juice as a possible addition to the North American diet, seeds collected in the Baños-El Topo region of Ecuador were planted in the greenhouses of the United States Plant Industry Station at Beltsville, Maryland, in October 1945 for further study of the plant under greenhouse conditions. Observations of these plants led to the following investigations: (1) The effect of day length on flower-bud initiation, (2) effect of growth-regulating substances on fruit set, (3) graft compatibility with other *Solanaceae*, (4) vegetative propagation, and (5) chromosome number.

Concerning the influence of length of day on flower-bud initiation, it was found that the naranjilla could be induced to flower about 2 months earlier when supplemental electric light was added to the normal day length of December and January so as to give at least 12 hours of light. This fact is readily understood when one considers that the native habitat of the plant is close to the Equator, where deviations from a day length of 12 hours are slight during the year.

The second problem to be considered was flower abscission. It was observed that under greenhouse conditions flower and pedicel tend to abscise from inflorescences. A series of growth-regulating substances* were applied to the flower and pedicel, and it was found that a 1:1,000 emulsion of naphthalene acetamide sprayed directly on open flowers would inhibit abscission and induce ovary expansion. The expanding ovaries grew into fruits that were one-half normal size and seedless.

The individual parthenocarpic fruits obtained by the artificial method of spraying the flowers with growth regulators were not of commercial size. Furthermore, the number of fruits set by this method was not high enough for commercial production.

Though commercial production of naranjilla fruits may be limited to the native habitat in Ecuador because of the unique ecological requirements of the plant, the use of growth-regulating substances may serve to extend planting within the general area.

Successful approach grafts and slip grafts of tomato on naranjilla were obtained. Grafts were made in October 1946, and tomato fruits were borne well into the summer of 1947. The following tomato varieties were used and all were successfully grafted: Rutgers, Bonnie Best, Marglobe, and Pan America. *Solanum mammosum*, a purple-flowered plant with spiny leaves, was also successfully grafted on *S. quitoense* rootstock.

Young terminal and lateral shoots were found to root readily in sand, or vermiculite, with or without the addition of root-promoting substances. The subsequent growth of the cuttings into mature plants was also satisfactory.

Lewis P. McCann is a geneticist in the Division of Fruit and Vegetable Crops and Diseases, BPISAE, USDA, Beltsville, Md.

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*Preparation of various growth regulators by Dr. Neil W. Stuart is gratefully acknowledged.

The chromosome number, hitherto unreported, obtained from root-tip smears is 2n–24. This number is characteristic of certain other *Solanaceae;* for example, *Lycopersicon esculentum*, the tomato (36), and *Solanum melongena*, the eggplant (48). The *Solanaceae* are a polyploid group with a basic or monoploid number of 12. Somatic or 2n numbers range from 24 in multiples of 12, to as high as 144 in *Solanum nigrum*. The majority of the species studied have 24 somatic chromosomes.

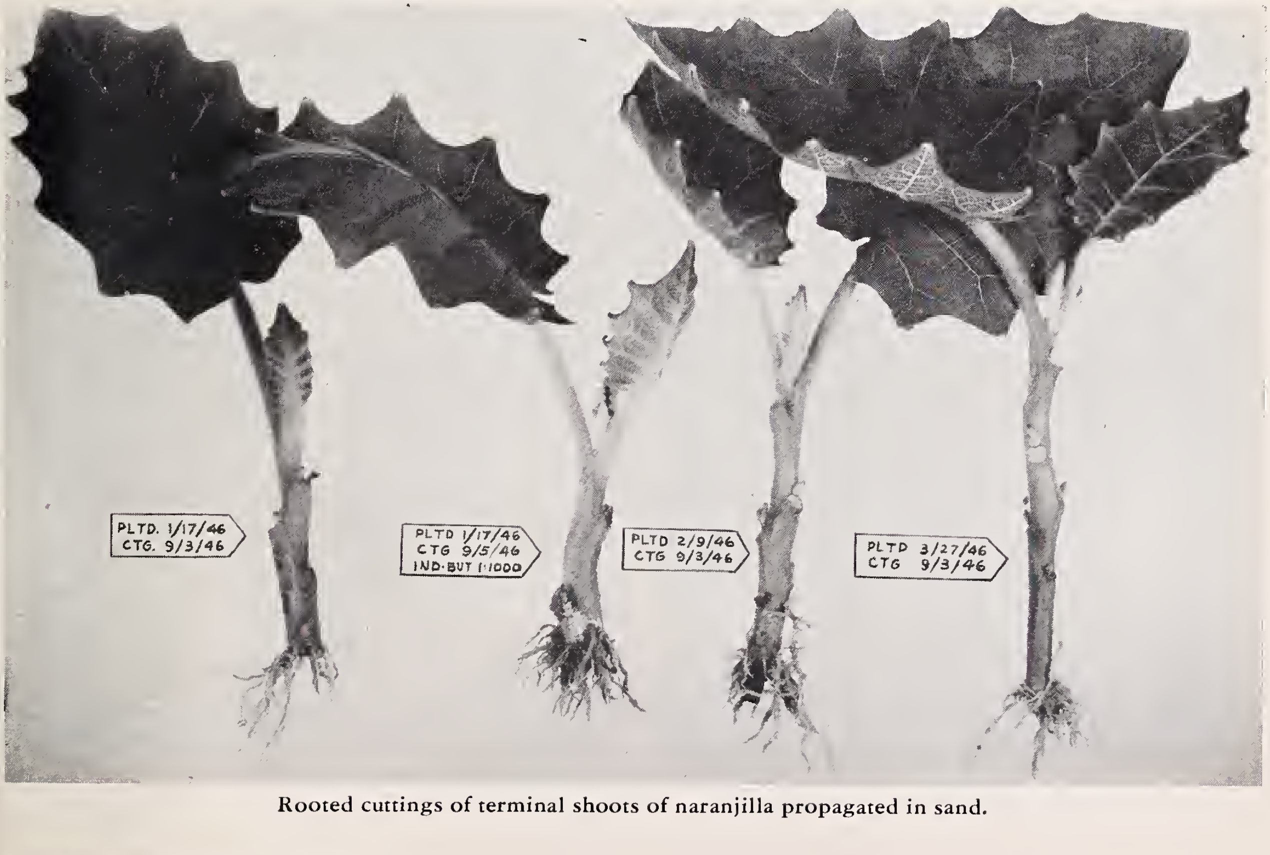
Commercial Possibilities

In 1939, at the New York World's Fair, naranjilla juice was offered to the public for the first time. Reports to the Ecuadoran Embassy and the U. S. Department of Commerce, as well as letters of inquiry to the Department of Agriculture, all indicated that the juice was relished by the North American public.

The Ecuadoran Government, on the other hand, has long been interested in the exploitation of this natural and native product. The importation of the fresh fruit into the United States has been limited by Quarantine No. 56, U. S. Department of Agriculture, covering the importation of fruits and vegetables from foreign countries, especially as this quarantine relates to the prevention of the introduction of the fruitfly *Rhagoletis ochraspis*. In 1941, however, the Ecuadoran Embassy in Washington, D. C., obtained a permit, under the provisions of Quarantine No. 56, for entry of naranjilla fruit through the northern ports of Baltimore, Philadelphia, New York, Providence, and Boston.

At the present time the most pressing problem confronting the Ecuadoran producer of naranjillas in placing his product on foreign markets relates to the need for improved methods and machinery for preserving the juice so that its unique and elusive flavor may be retained in canning or bottling for export. Small canneries or bottling factories placed in, or near, the production areas would greatly reduce handling, as well as loss in transport by pack animals and trucks over muddy trails and difficult roads.

In view of the experience in various parts of the United States over a period of years, and the recent experiments reported here, the production of naranjillas apparently will be limited to the plant's native habitat in Ecuador and, perhaps, to other areas that can meet all the requirements for proper growth and fruit production characteristic of the Andean equatorial climate. The assurance of a steady market at a fixed price would doubtless encourage expansion and greater production.



Rooted cuttings of terminal shoots of naranjilla propagated in sand.

Quinoa—Ancient Food Crop in South America

Quinoa may never become an important cereal in the world at large, but for centuries it has been significant in the diet of the people living in the Andean Sierra. The seed is about the same in size as a grain of edible millet.

by HUGO W. ALBERTS

Quinoa has been grown by the Indians of the mountainous regions of Peru, Bolivia, Ecuador, and some other South American countries since time immemorial. It is indigenous to Andean America and is said to have originated in the vicinity of Lake Titicaca.

The Incas regarded quinoa as a sacred plant; they cultivated it more generally than any other crop, except potatoes. They are said to have used a golden implement to open the first furrow in the quinoa field to announce each year the beginning of the sowing season. A part of the harvest was used as a religious offering to the Sun in the temple at Cuzco, where services were conducted with great solemnity at the solstice festivities.

During the colonial period quinoa was replaced by such crops as wheat and barley to the extent that today it is cultivated on a small scale only for local use by the Indians of the Sierra. Many attempts have been made to grow quinoa in other regions, but, so far, it does not appear to have been established anywhere outside South America.

Quinoa seed or grain.

Many Varieties of Quinoa Grow in South America

Quinoa (*Chenopodium quinoa*) grows both wild and under cultivation in the South American mountains. It thrives best at an altitude of about 9,000 to 12,500 feet above sea level. According to 1929 statistics, the total area planted to quinoa in Peru the previous year was 26,000 acres, of which 28 percent was in the Department of Puno. Smaller seedings were in Junin, Huancavelica, Cajamarca, Arequipa, and Cuzco. In recent years the total acreage is believed to have been considerably less.

The seed of quinoa are planted from September to November, in rows from 20 to 40 inches apart, or they are strewn broadcast, generally at the rate of about 15 pounds to an acre. They are covered with soil by means of a primitive plow, harrow, or thorny branches, with the result that some seed lie on the surface of the ground, whereas others may be as much as 1.5 inches deep. They germinate rapidly, and in 8 or 10 days from the time of planting the seedlings emerge from the ground. The plants must be weeded, thinned, and later hilled in order that they may stand firmly in the ground. Quinoa tolerates light frosts and produces good yields with only a comparatively small amount of rain.

Although the plant grows on various types of soils, it prefers those that are rich in lime, potassium, and magnesium. The plant is shallow-rooted and has a hollow stem, resembling the weed known in the northern part of the United States as lambsquarters (*Cheno-*

Hugo W. Alberts, Agricultural Attaché, American Consulate General, Guayaquil, Ecuador, was formerly stationed in Lima, Peru, where this article was written.

A mixed planting of quinoa growing at an altitude of 10,600 feet.

podium album). Some of the leaves are reddish or purplish in color. The plants with reddish leaves are believed to absorb more heat than those having green leaves; consequently, they are believed to tolerate lower temperatures.

The leaf cells are rich in calcium oxalate. They have the appearance of being covered with fine, glassy sand and sparkle slightly when viewed at a certain angle with the sun's rays. The plant is an herbaceous annual, generally a little over 3 feet tall, but sometimes attaining a height of as much as 8 feet. At lower elevations, quinoa is often intercropped to form a windbreak for young corn and potato plants.

The vegetatve period of the plant is from about 5 to 6 months. When grown for grain, the whole plant is cut and left to dry for several days in the sun. Then it is flailed with a stick. The seed are cleaned by winnowing in the breeze, threshing machines being used only in exceptional cases.

In 1929 the average yield was approximately 750 pounds of seed to an acre. Ordinarily quinoa returns from 450 to 900 pounds of grain per acre, but it has been known to yield nearly 2,700 pounds, under reasonable cultivation.

More than 100 varieties of quinoa are known. The seed of the different varieties are of several colors, including white, ivory, red, yellow, black, and striped. A few varieties have been selected as being most productive; the most favored is *blanca real*, which has a large flattened grain. The skins of the grains are said to be less bitter than those of most other varieties.

Two species of plants similar to quinoa grow in several South American countries and might also be used for food. *Cañahua* (*Chenopodium pallidicaule*), also known as *canigua*, closely resembles quinoa. It is grown at higher elevations on account of its shorter vegetative period—from 135 to 145 days, compared with 165 to 175 days for quinoa. The other is *quihuicha* (*Amaranthus caudatus*), also known as *achita*. The seed of this plant, a member of the pigweed family, could be used much as quinoa seed are utilized.

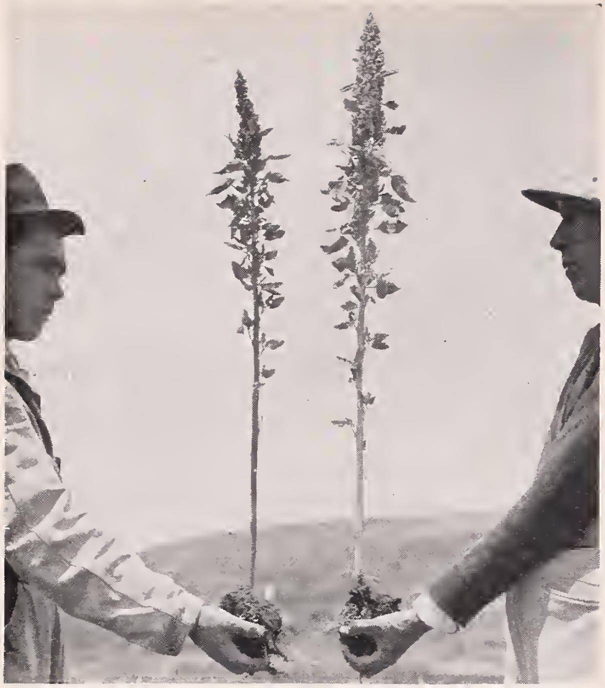
Diseases and Insects

Quinoa, in general, is attacked by few diseases. Observations indicate that it is susceptible only to a fungus, *Peronospora effusa*, which occurs on the leaves but causes little damage.

Quinoa suffers occasionally from insect damage. Several species of cutworms attack the young plants. Larvae of *Laphygma frugiperda*, *Feltia experta*, *Xylomyges eradania*, and *Lycophotia interrupta* feed upon the seedlings soon after they emerge from the soil. The adults of two species of beetles, *Epicautia latitarsis*

Peruvian Ministry of Foreign Relations.

Quinoa ready for harvest.



The plant at the left is "Quinoa sylvestre," a reddish variety which grows wild in Peru; the plant at the right is "Quinoa blanca," a selected variety for cultivation.

and *E. willei*, eat the plants voraciously, as they do also the leaves of potatoes. From the months of January to March, they may destroy entire fields of quinoa. The larvae of these insects, on the other hand, are beneficial, because they feed on the eggs of the migratory South American grasshopper, *Schistocerca paraensis*. The leaves and inflorescences of quinoa are eaten also by *Pachyzancla bipunctalis* and *Zinckenia fascialis*. Both species unite the leaves and small branches of the heads of quinoa plants with fine threads so that they appear as if drawn together tightly. In this nest of leaves, branches, and inflorescences the caterpillars live. From it they spread out until they destroy the entire plant. The larvae of the two species of insects are alike in appearance; they are dark green in color and have brown or almost black heads.

Greatest crop losses, however, are caused by numerous species of small birds. They eat the immature seed before the crop is ready for harvest.

Uses of Quinoa Are Varied

Quinoa is used as human food, in the preparation of a beverage, and as feed for poultry and livestock. The Indians of the Sierra eat the seed cooked, toasted, or in the form of tortillas, as well as in soup and porridge. Preliminary tests made at Ambato, Ecuador, indicate that the seed are valuable as an ingredient of a feed ration for turkey poults.

A quinoa seed contains about the same percentage of moisture, protein, cellulose, calcium, phosphorus, and caloric value as in wheat but considerably less carbohydrate. Quinoa has nearly twice as much protein as in rice but 30 percent less carbohydrate and 3.5 percent less caloric value. A small amount of the ashes of the quinoa stem is said to be chewed by the natives with coca leaves to aid in releasing the cocaine from the latter.

Quinoa flour has been mixed in small quantities with wheat flour for making bread. During the period of the wheat shortage at the beginning of World War II, the Government of Peru passed a resolution requiring that millers produce flour of 80 percent wheat, 15 percent rye, and 5 percent quinoa, but the attempt to enforce the use of quinoa in bread making through legislation was not successful. The only people whose diet regularly includes quinoa are Indians of the Lake Titicaca region and, to a lesser extent, of other Sierra regions remote from towns. People who have funds for buying cereals, usually try to obtain rice.

In some regions quinoa is used in making a *jora* or mash, from which the alcoholic drink known as *chicha* is sometimes made. The tender stems and leaves can be eaten as salads and greens. A large part of the production is utilized as poultry feed. In the region of Puno the green stalks of quinoa have been fed to livestock. One test indicated that quinoa formed a desirable green feed that stimulated the growth of young calves.

Future Prospects For Quinoa Production

The production of quinoa in Peru could probably be increased to many times the present outturn without necessarily replacing barley or wheat. It has been reported that the Arequipa region could furnish 110 short tons monthly, and large quantities could certainly be produced in the regions of Puno, Cuzco, Huancayo, Tarma, Huarás, and Cajamarca.

An increase in the consumption of quinoa would, however, probably be as difficult to achieve as an expansion in the consumption of rye bread and barley bread in the United States. Attempts have been made in the past to find an export market for quinoa, especially in the United States, but so far only trial shipments have been made.

Dominican Yuca Plays a Dual Role

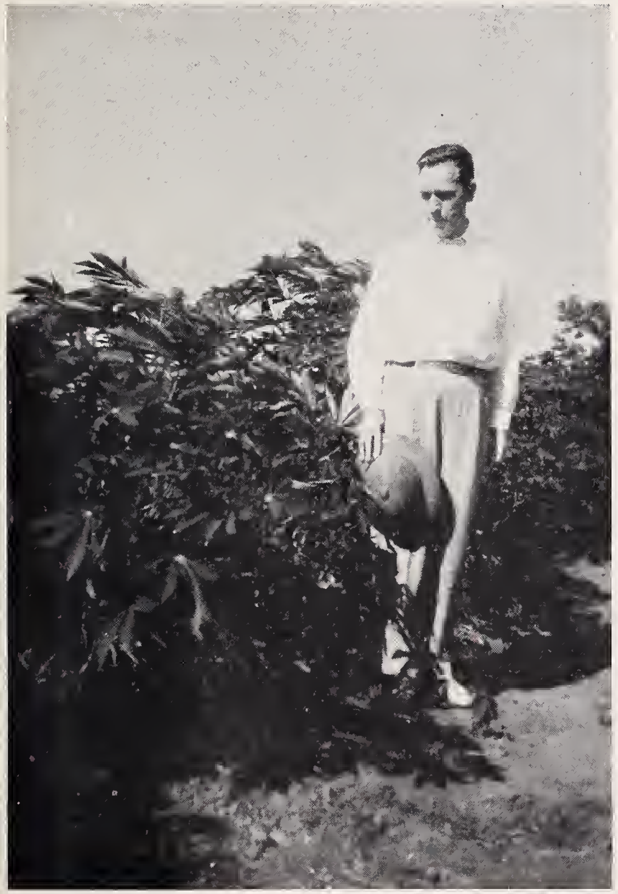
In the Dominican Republic yuca serves as both a subsistence and a cash crop. Prepared in various ways, it is a nutritious food, and, in the form of flour or starch, it is a valuable export item.

by ROLLO P. STOVALL

The tuberous starch root known as *yuca* in the Dominican Republic is called manioc, mandioca, or cassava in some other producing areas of the world. When the Spaniards reached Hispaniola in the fifteenth century, they found several varieties under cultivation, the plants probably having spread from Brazil.

The root is important in the Dominican Republic, because it is grown both for food and for sale or export as flour. Commercially, yuca is produced under contract for the largest tapioca-flour mill in the Western Hemisphere, the output of which is almost entirely exported to the United States. Very little wheat flour, all of which is imported into the Republic, is adulterated with manioc flour as has been required in some countries, particularly Brazil.

The species of yuca usually cultivated in the Dominican Republic is *Manihot esculenta* Crantz (*M. utilissima* Pohl). The roots of some varieties are known as bitter or sweet (*amarga* or *dulce*), depending on the



Courtesy Chan Valverde Pastoriza.

Irrigated yuca plants show good progress at 2 months of age, but irrigation is the exception rather than the rule.

The yuca plant is propagated from the stalk, cut in 3- to 6-inch lengths, before planting.

amount of a poisonous glucoside, akin to prussic or hydrocyanic acid, which they contain. Some of the more common varieties of the sweet are called *machetazo*, *San Juanero*, and *tres ganchas;* important bitter varieties are *cogolla de Rosa*, *negrona*, *audujita*, *Mocano*, *miseria*, and *mata gato*. The cogolla de Rosa is sweet for the first 6 or 7 months and then turns bitter. The starch or flour yield of yuca is about 25 to 30 percent, depending on the soil, rainfall, and other factors. The sweet varieties, as compared with the bitter, have from 18 to 25 percent more starch.

Although yuca is cultivated in practically all parts of the Republic where farming is undertaken, the principal production is in the Cibao area,* in both the highlands and lowlands, in the Provinces of Santiago, La Vega, Puerto Plata, and Monte Cristi. It grows best in a well-drained light or sandy loam soil. The plant is propagated by cutting the stems into pieces, 3 to 6 inches in length, and planting them in the soil, either in a horizontal or a vertical position. Planting in a vertical position, with a small part of the stem above the ground, is believed to be the better method.

The green worms that attacked this yuca field have disappeared, and new leaves are beginning to appear.

The Dominican Department of Agriculture recommends that yuca be planted throughout the year, except during the months of June, July, November, and December, but of course planting in a particular district depends on seasonal rainfall or other local factors. The growing plants are given little care and are often interspersed with other crops. They usually do not grow more than 6 feet in height. While the best time to harvest the roots is about 18 months after planting, yuca may be dug after 6 or 7 months. The usual yield is about 10 tons to an acre, this yield being lowered by extremely dry weather or improved by favorable rainfall.

Plantation Production Proves Unsatisfactory

About 1930, the Corn Products Refining Company (United States) formed a subsidiary (incorporated under Dominican laws), which signed a contract with the Dominican Government that provided for the plantation cultivation of yuca and the construction of a large factory for extracting tapioca flour from the roots. This company undertook the cultivation of about 6,600 acres but suffered numerous adversities because of heavy rains, green worms, and then periods of drought or extremely dry weather. The company tried unsuccessfully to combat the green worms, which are the larvae of the moth *Erinnyis ello*, a relative of the army worm. It purchased the worms by the bucketful from the *campesinos*, who picked them from the plants, until at one time it appeared that worms were being raised to sell to the *yuquera!*

The company finally reached the conclusion that large contiguous fields were unsuitable for yuca cultivation, since the worms would not permit any leaves to grow and had an unlimited feeding ground the year round once a field was attacked. It then resorted to contracting with the individual farmers for the production of yuca and abandoned, or leased, its plantation properties. On a small farm the worms' attack is limited to summer and fall.

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*See p. 73 of the April–May issue of *Agriculture in the Americas* for map showing the Cibao Valley.

Yuca roots on the left are 18 months old; those on the right, 7 months.

Contracts with approximately 2,000 farmers are in force at the present time, with the average *colono* cultivating 10 or 12 tareas (6.5 tareas equal 1 acre), although the area cultivated by colonos runs from 5 to 2,000 tareas. The colonos will receive $10 a ton for their 1948 output. The company operates a large fleet of trucks and has a number of pack animals which transport the roots from the colonos' farms to the factory.

During periods of drought, when other food crops suffer more than the growing, or mature, yuca does, the roots originally grown for the yuquera are eaten, and the factory must shut down or operate irregularly. High prices of other foodstuffs also cause the yuca to be sold in the open market. Since the roots can be dug at any time, the colono often eats all his production. As the plants are destroyed when the roots are gathered, he thus loses the "seed" which he should have saved for planting.

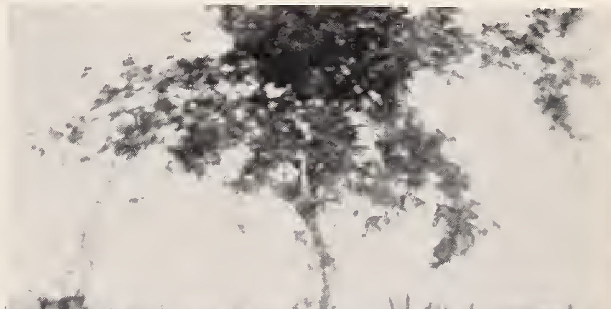
The factory, which has the capacity to grind 330 tons of roots daily, ground from 50,000 to 60,000 tons of roots annually and had available for export from 12,000 to 14,000 tons of tapioca flour annually, during its best years (1941, 1942, and 1943). Its facilities for extracting the flour from the yuca roots are modern in every way.

The tapioca flour is used in the United States in the textile and paper industries, for making glue, laundry starch, explosives, and other miscellaneous products, in addition to being made into tapioca, which is sold on the grocery shelves for human consumption. (In the peeling of the roots and the washing of the starch in the extracting process, the poisonous glucoside is driven off, since it is in the skin or outer part, whereas the starch is concentrated in the central part of the root.)

Yuca for Home Use

The Dominicans eat the yuca root as it comes from the ground after peeling and cooking it (cooking also drives off the poison). They put it into their national dish, *sancoche*, which is a kind of stew. Another favorite way of eating yuca is as *casabe*, which is made from a coarse meal obtained from the root. For this the root is peeled and then grated on a home-made grater or rasp; it is then placed in a crude press and allowed to stand for a day while the liquid which contains most of the poison is expelled from the pulpy mass. This moist yuca meal is then made into a flat-tasting pancake or casabe by heating it on the flat iron top of a clay stove. The meal is also used in making a bread, fried in deep grease, which is similar to the crackling or shortening bread of southern United States.

Although yuca is used by the Dominicans to make a laundry starch, medicinal powder, and puddings, it is not used in the pearl-tapioca form so common in the United States for dessert purposes.



Campesinos scrape and rasp (grate) yuca to make a coarse meal.

FAO Conference at Geneva

At the third session of the Conference of the Food and Agriculture Organization of the United Nations, held at Geneva, Switzerland, from August 25 to September 11, several proposals were made that were of particular interest to Latin America. The principal subject of consideration was the report of the expert Preparatory Commission on World Food Proposals which was created at the Copenhagen Conference last year. A decision was reached to begin holding an annual review and consultation on the world food and agricultural outlook and national programs as an especially important part of the Conference. The question of a permanent location for FAO received attention, as did the establishment of regional offices, the scale of contributions by Member governments, examination of the program of the technical divisions, and other matters of organizational and administrative interest.

Delegations representing 46 of the 54 Member nations attended. The Western Hemisphere was represented by members from Bolivia, Brazil, Chile, Cuba, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Peru, Uruguay, Canada, and the United States. Colombia and Argentina, a non-Member nation, were represented by observers. There were also delegations, representatives, or observers from various international organizations, the military occupation authorities, and governmental and nongovernmental agencies. José L. Colom, Chief, Division of Agricultural Cooperation, represented the Pan American Union.

The Conference set up three Commissions and referred appropriate agenda items to each. The Report of Commission I to the Conference stressed the world food situation, with particular emphasis on the adverse crop conditions, especially in European countries, and the need for stretching existing supplies in producing countries. Commission II reported on the technical activities of FAO, the work of the Technical Divisions covering Agriculture, Nutrition, Fisheries, Forestry and Forest Products, and Economics, Marketing, and Statistics. It also made plans for a World Census in 1950 of Agriculture, Forestry, and Fisheries and for a Rural Welfare Division. Among the recommendations of Commission II the following related to the other Americas:

> That a Nutrition Conference be convened in South America in the course of 1948. The objectives of the Conference should include the promotion of cooperation between FAO and nutrition workers in Latin America and the consideration of suitable programs for the study and attack of the serious problems of nutrition which exist in this part of the world.

This Commission also reported, with regard to forestry and forest products, as follows:

> *Policy for Latin America.*—Additional lumber supplies are urgently needed for the reconstruction of war devastated countries, and the development of Latin American forest resources and industries could also make a major contribution to the economy of Latin American countries. The Commission, therefore, requests the Director-General to call a Latin American Forestry and Forest Products Conference and to determine its date and location as soon as possible, and calls on all Governments of that region to take an active part in the Conference and to cooperate in the adoption of programmes which will produce the desired results in a minimum of time.

Included in the agenda of Commission III was the question of establishing regional FAO offices, and the unanimous conclusion was that they should be set up. The discussion covered four main headings—location, functions, finance, and the time of establishment. It was generally agreed that the offices should be located in Europe, the Near East, Asia, and Latin America. The delegations from the Latin American countries advocated not less than three offices—one each for the Atlantic, the Pacific, and the Caribbean areas. The functions of all regional offices were held to be that the maximum use be made of existing local and regional organizations; that close liaison be maintained with the work of other international organizations at the regional level; and that the problems of each region as a whole be emphasized rather than the problems of individual countries within a given region.

The final decision of the Commission was a resolution, recommended for adoption by the Conference, that—

> . . . the Director-General be given authority (1) to proceed with the work of establishing regional offices . . . and to prepare forthwith, in consultation with Member countries and other international bodies, plans for the approval of the Executive Body whereby offices may be established in each principal region and more especially in Latin America, Europe, the Middle East, and Asia; and (2) in doing so, to take advantage of any regional machinery when planning and carrying out technical missions with a view of attaining the highest possible efficiency at a minimum cost.

ALONG THE *Agricultural Front*

▲ Dried Coffee Pulp— A Promising Tropical Feed

Investigations indicate that dried coffee pulp may be a valuable substitute for corn or other concentrates for feeding livestock, particularly dairy cows. In digestibility studies and feeding studies the pulp has been found to compare favorably with corn. Mixed with dried banana leaves, molasses, or other feedstuffs, the pulp has also been found to be satisfactory as to palatability.

For temperate climates the use of coffee pulp is of little interest because of the availability of corn and other feeds. In tropical countries, however, where the well-known feedstuffs of Temperate Zones may be scarce, too costly, or entirely lacking, coffee pulp and other, as yet untested, materials may prove a boon to livestock producers.

▲ Mexico Moves Against Sigatoka

Mexico has issued new regulations for the control of the banana disease known as sigatoka to be effective October 1, 1947. A permit is now required for the transporting of bananas to local markets as well as for export. These permits are granted to those persons only who comply with certain prevention and control measures, such as the removal of excessive shoots, dead leaves, and weeds from banana plantings; spraying at required intervals; and the use of fungicides recommended by the Ministry of Agriculture and Livestock. Under earlier regulations, spraying every 21 days was required during the rainy season; now it must be done every 15 or 20 days. The Ministry of Agriculture is to prepare a program to be followed in banana regions. Also, the maximum fine for violation of regulations has been increased from 500 to 10,000 pesos.

▲Colombia's New Agricultural Station

A new agricultural station has been authorized in Colombia by the Departmental Assembly of El Valle del Cauca. This is to be located at Calima, in the municipality of Buenaventura, and is to be known as the Estación Agro-Forestal del Pacifico. Management is to be under the direction of the Departmental Secretary of Agriculture and Development, and Victor Manuel Patiño was named as Director.

The objectives of the station, in brief, are to experiment with food crops for human and animal consumption to supply the coastal areas; to study and organize a systematic forestry program; to acclimatize, study, and propagate new species of economic plants and trees; and to study the possibility of establishing a livestock industry adapted to the coastal areas.

▲Panama Plans National Fair

According to information released by the Minister of Agriculture and Commerce, Panama will hold a National Fair in 1948. It will be in the Province of Chiriquí during the week of February 21–29. The President of the Republic has expressed interest in the undertaking and has promised full cooperation of the Government within the limits of the national budget. It will cover all phases of the agricultural, livestock, and industrial pursuits of the Republic.

▲Livestock Exposition at Bogotá, Colombia

The Third Annual Exposition of Holstein-Friesian cattle, held near Bogotá last August, was inaugurated with an address by the President of the Republic and attended by many dairy-cattle enthusiasts, Cabinet members, and other outstanding Colombians. Some 35 of the country's breeders showed their finest animals. Most exhibits were from herds located within a 50-mile radius of Bogotá, but one breeder flew several entries from the Cauca Valley.

▲ Machetes for the Dominican Republic

The all-purpose tool of the Tropics — the machete — is not manufactured on a commercial scale in the Dominican Republic. Yet some 10,000 dozen of these versatile implements are needed each year by the small farmers and agricultural workers who represent a large segment of the total population. About a third of the requirements are for short, wide-bladed knives for use in cutting sugarcane. The others, of regulation size and style, are for general agricultural activities—from the clearing of land to the harvesting of crops.

Before the war Germany supplied most of the machetes imported by the Republic. Today, however, the United States is the principal source, and a law of June 1947 provided for the free entry of machetes, along with spades, pickaxes, rakes, forks, shovels, etc., employed in agriculture.

Reading about the AMERICAS

Dust on the King's Highway, by Helen C. White. 468 pp. The MacMillan Company, New York, N. Y., 1947. The scene of this novel is laid in the Mexico and California of two centuries ago. Its hero is Father Garcés, who at the request of four stalwart redskin messengers who appeared one morning at his mission, set out to take the white man's "magic" to the Yuma Indians of the north. His zest for adventure was only exceeded by his zeal for saving souls. In the final tragedy which befell him, his body was clubbed; but his spirit rose triumphant, and his memory lived long in the hearts of the Yumas.

Call for Forty Thousand, by John J. Considine. 319 pp. Longmans, Green and Company, Toronto and New York, 1946. In this book, the reader travels throughout Latin America. He sees little of the beauties extolled by tourist guidebooks but much of the wretchedness of lowly folk in every country of South America, the Caribbean area, Central America, and parts of Mexico. The author stresses the great need for more religious teachers and leaders, but throughout the journeys he holds the attention of his readers just as he did when describing his travels, through Asia and Africa, in *Across the World.*

Diseases of Field Crops, by James G. Dickson. 429 pp., illus. McGraw-Hill Book Company, Inc., New York, N. Y., 1947. A revision and expansion of the author's earlier work, *Outline of Diseases and Forage Crop Plants of the Northern Part of the United States*, this book is divided into sections; one covers the diseases of cereals and grasses, another diseases of legumes, and a third diseases of fiber and other field crops. Two introductory chapters discuss, respectively, the association of plant diseases with the history and development of field crops and the physiological anatomy of plant groups. The diseases of field crops are listed in appendix A, according to causal factors, and in appendix B the bacteria and fungi parasitic on field crops are arranged under orders and families, with the more common suscepts. The volume, extensively documented and well-indexed for ready reference, contains valuable, up-to-date information for those interested in crop production and plant pathology.

Paquita, by Robert Raynolds. 369 pp. G. P. Putnam's Sons, New York, N. Y., 1947. This historical novel, with its setting in Mexico in the early nineteenth century, portrays the conflict of that era between the wealthy Spanish noblemen and the lowly Indians who longed for freedom for themselves and for the land they loved. Interwoven with the spritely, humorous romance of a lovely daughter of Spain, who avows her intention to enter a convent to the evident satisfaction of the attendant priest and the ill-concealed consternation of her worldly father, are many beautiful descriptions of the countryside. The reader lays the book aside with the feeling of having had a pleasurable sojourn with acquaintances who have become friends and with a better understanding of the problems of our neighbor to the south.

Animal Nutrition, by Leonard A. Maynard, 494 pp., illus. McGraw-Hill Book Company, Inc., New York, N. Y., 1947. This is a second edition of a standard text presenting the chemistry and physiology of nutrition and their application to the feeding of farm animals. The new edition includes recent developments in amino acid, vitamin, and mineral nutrition, and greatly expanded discussions of copper, manganese, magnesium, and cobalt.

Editor's Note.—The listing of publications here does not necessarily imply an endorsement of them by the Department. For copies of private publications, write direct to the publishing agency given in each case.

AGRICULTURE IN THE AMERICAS HALLY H. CONRAD, EDITOR

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U. S. GOVERNMENT PRINTING OFFICE: 1947

Gifts of the Americas

THE OITICICA NUT

by MARY S. COINER

The oiticica nut or seed is the fruit of a large symmetrical evergreen tree believed to be native to the State of Ceará in northeastern Brazil. In the nineteenth century a German monk, on a scientific expedition to the country, first saw industrial possibilities in the oil of the nut. In recent years chemical research has proved oiticica oil to be a practical substitute for Chinese tung oil, and investigations indicate that a good supply is usually obtainable. At present the trees are most abundant in Ceará and Rio Grande de Norte, although appreciable numbers also occur in Piauí, Paraíba, Pernambuco, and Bahia.

The oiticica tree, classified botanically as *Licania rigida* Benth., attains a height of from 50 to 100 feet. Its main trunk is about 6 feet high, very thick and frequently divided into several boles. Long slender branches support thick green leaves, which are oval in shape.

Flowering begins at the close of the rainy season in July and continues to October and even to December; harvest is from January to April. Upon ripening, the fruit will often remain on the tree during the rainy season. The trees usually occur in dense stands, preferring the banks of rivers, brooks, and lakes. Occasionally solitary, beautiful specimens, bearing bountiful crops of nuts, are found on barren hilltops.

The nut, similar to the pecan in shape, is from 1 to 2.4 inches long. The kernel, which constitutes from 60 to 70 percent of the nut's weight, yields from 60 to 63 percent of oil. The thin outer shell is easily broken and removed.

Gathering of the ripe nuts is done by independent Brazilian laborers called *caboclos.* They pick the nuts from the lower branches of the trees and dislodge the rest by vigorously shaking the trees or by hurling sticks and stones into the upper branches. The yield per tree averages more than 300 pounds. The nuts are collected in sacks, old gasoline cans, or other containers, which are fastened to the back of a burro and transported from the interior to storage depots. Usually a caboclo leads his own burro, but sometimes one who is more enterprising will have a string of 20 to 40 burros, each carrying about 450 pounds of nuts.

Brazilians have used oiticica oil for many years as fuel oil in lamps, for medicinal purposes, and, mixed with resin, for calking boats. Early extracting methods were extremely primitive. The nuts were hulled and the kernels crushed in a hand press. This mass was then mixed with water and heated. As the oil came to the surface, it was skimmed off and purified with a hot-water treatment.

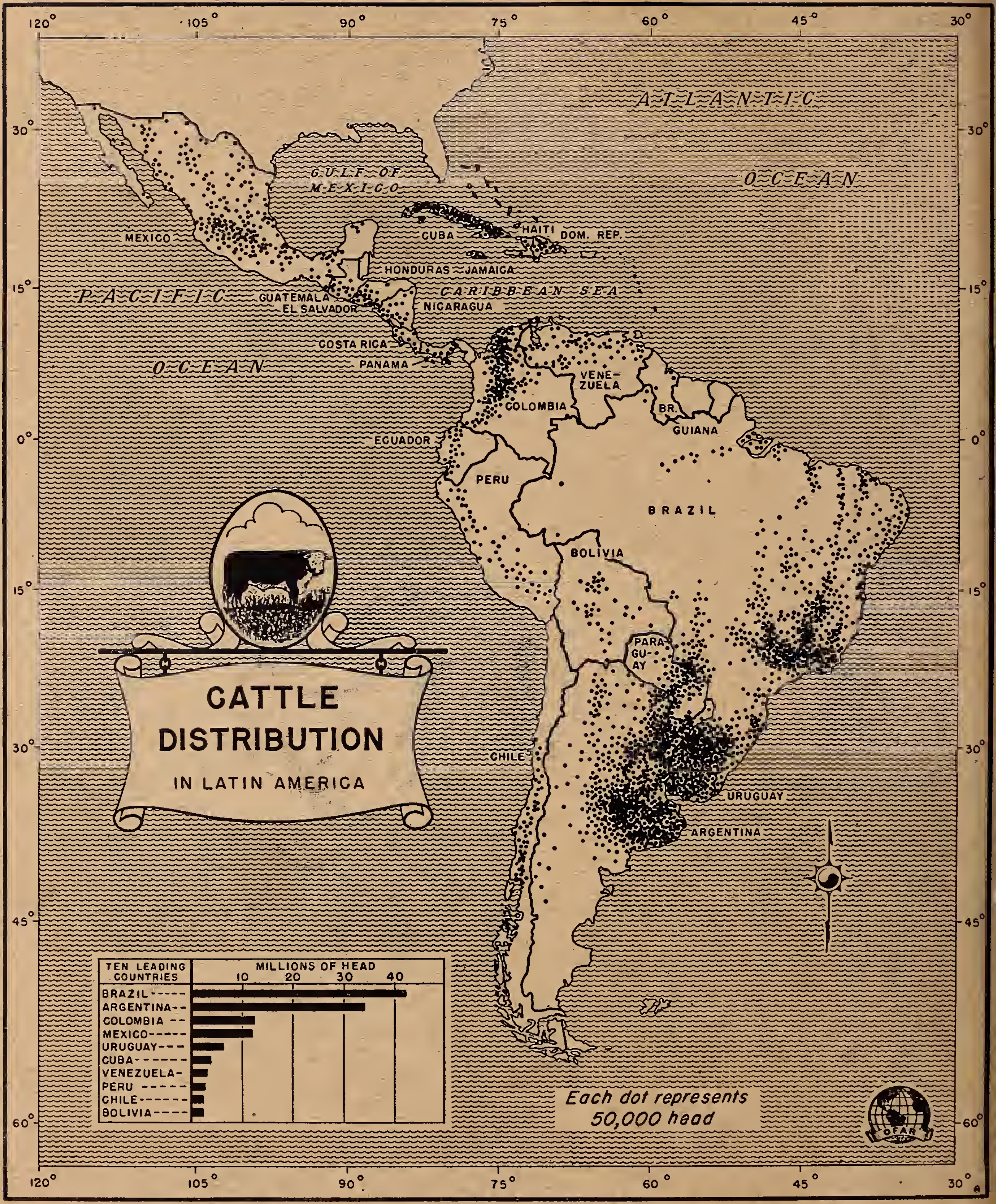
Acting on the suggestion of the German monk, Friar Allemao, that oiticica oil might be industrially useful, a manufacturer in Fortaleza, around 1876, imported crushing machinery. The oil obtained was of inferior quality, however, and the soap made from it retained its disagreeable odor. When attempts to deodorize the oil were unsuccessful, interest in use of the machinery died out.

Attention to the possibilities of oiticica nuts as a source of oil was renewed during World War I, and a small extraction plant was erected in Natal. The oil was used locally in the manufacture of paints, but its properties still were not thoroughly understood, and soon interest in it faded out again. New methods of extraction were introduced in 1927 in a Rio de Janeiro plant, and 2 years later a plant began operations in Fortaleza. Meanwhile, despite recognition of its excellent drying qualities, the oil continued to be unsatisfactory as a component of paint.

Continuing scientific research finally evolved a special treatment for transforming the raw oil; as a result, the output began to increase and has expanded steadily during the past 15 years. Extraction involves either the solvent process or the use of hydraulic presses.

Like tung oil, oiticica oil is now primarily consumed by the paint and varnish industry. It is also used in the manufacture of linoleum and printing inks. The elasticity of certain rubber products is said to be improved by the addition of the oil, and it is used in automobile brake bands. The residue left from the crushing operations has value as fuel and fertilizer, as have the shells of the nut.

Oiticica has already brought to the people of northeastern Brazil a certain amount of prosperity, and the positive steps being taken to encourage production indicate that it will be an important aid in the Government crop-diversification program.



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